

NEAR EARTH ASTEROIDS (NEAs)

A CHRONOLOGY OF MILESTONES 1800 - 2200

version 121 – 01 November 2021
(completeness not pretended)

Introduction

An asteroid is coined a **Near Earth Asteroid (NEA)** when its trajectory brings it within 1.3 AU from the Sun. A **NEA** is said to be a **Potentially Hazardous Asteroid (PHA)** when its orbit comes to within 0.05 AU (= 19.5 LD = 7.5 million km) of the Earth's orbit and has a measured absolute magnitude $H < 22$ mag (i.e., an estimated diameter $D > 140$ m).

As of 31 October 2021, 27202 **NEAs** are registered by NASA JPL CNEOS, including
891 **NEAs** with $D > 1000$ m (95 % of an estimated population of 940 ± 10);
8,991 **NEAs** with $1000 \text{ m} > D > 140$ m (36 % of an estimated population of 25,000);
8,453 **NEAs** with $140 \text{ m} > D > 40$ m (1.7 % of an estimated population of 500,000);
4,867 **NEAs** with $40 \text{ m} > D > 20$ m (0.2 % of an estimated population of 2,500,000);
4,000 **NEAs** with $20 \text{ m} > D$
Among the 893 km-size **NEAs** are 161 **PHAs**.
See: https://ssd.jpl.nasa.gov/tools/sbdb_query.html

Amor, Apollo, Aten and Atira NEAs

Definitions

Amor Earth approaching asteroid with orbit exterior to Earth's orbit, but interior to the orbit of Mars. **Amor** was discovered 12 March 1932.
Apollo Earth orbit crossing asteroid with semi-major axis larger than that of Earth. **Apollo** was discovered 24 April 1932.
Aten Earth orbit crossing asteroid with semi-major axis smaller than that of Earth. **Aten** was discovered 7 January 1976.
Atira Earth approaching asteroid with orbit interior to Earth's orbit. **Atira** was discovered 11 February 2003.

Occurrence

As of 29 October 2021, the 27187 registered **NEAs** include 15111 **Apollos** (55.6 %), 9948 **Amors** (36.6 %), 2102 **Atens** (7.7 %), and 26 **Atiras** (0.1 %).
See: <https://cneos.jpl.nasa.gov/stats/totals.html>

First observed **NEA** flyby at $d < 1$ LD : 18 Jan 1991, **1991 BA** ($D \approx 8$ m).
First observed **NEA** flyby at $d < 0.1$ LD : 31 Mar 2004, **2004 FU162** ($D \approx 8$ m).
Closest observed **NEA** flyby, at $d \approx 1.06 R_{\text{Earth}}$ from the geocenter, on 13 Nov 2020: **2020 VT4** ($D \approx 6$ m).
One but closest observed **NEA** flyby, at $d \approx 1.46 R_{\text{Earth}}$ from the geocenter, on 16 Aug 2020: **2020 QG** ($D \approx 4$ m).
See: <https://www.jpl.nasa.gov/news/news.php?feature=7728>
But see also: <http://neo.ssa.esa.int/newsletters> [4 September 2020]

The NEA chronology lists:

- (a) data of known **NEAs** with past nominal Earth close approach distances $d \leq 1.00$ LD;
- (b) data of known **NEAs** with future nominal Earth close approach distances $d \leq 10.00$ LD and minimum close approach distances $d \leq 1.00$ LD;
- (c) data of known **PHA**'s with $H \leq 22$ mag and nominal Earth close approach distances $d \leq 5.00$ LD;
- (d) scientific literature, conferences and other milestones of **NEO** research.
- (e) interstellar minor planets

The *NEA Chronology* is updated monthly and can be downloaded as pdf file.

Information on categories (a) and (b) is quoted from both the [ESA NEO Coordination Centre Close Approach Tables](#) and the [NASA JPL CNEOS Close Approach Tables](#) for the period 1900 – 2200 A.D., as of 01 November 2021.

By listing in chronological order this broad selection of milestones of **NEO** research, a global impression is offered of what has been done and has happened, and what is being done and will happen in those fields, as far as presently known.

As 1 November 2021, the *NEA Chronology* lists 5965 entries of known *past* events registered since AD 1800, including 802 *observed* (the first one in 1991: **1991 BA**) and *calculated* close approaches of **NEAs** ranging in size from 1 to 325 m (including 8 **PHAs**, one in the km class (**2011 MD5**)) with nominal Earth close approach distances $d \leq 1.00$ LD (82 in 2019; 108 in 2020; to date 115 in 2021), 44 of which with $d \leq 0.10$ LD. Moreover, seven impacts have been recorded: on 30 June 1908 (Tunguska), 6 October 2008 (**2008 TC3**, Sudan), 15 February 2013 (Chelyabinsk), 2 January 2014 (**2014 AA**, off the coast of West Africa), 2 June 2018 (**2018 LA**, Botswana), 18 December 2018 (Bering Sea), and on 22 June 2019 (**2019 MO**, Caribbean Sea).

As of 1 November 2021, the *NEA Chronology* lists 685 entries of known *future* events announced and predicted up to AD 2200, of which 365 *predicted* close approaches of **NEAs** with nominal Earth close approach distances $d \leq 10.00$ LD and minimum close approach distances $d \leq 1.00$ LD (i.e., about one per year), including 62 *predicted* close approaches of **NEAs** with nominal Earth close approach distances $d \leq 1.00$ LD (10 of which are **PHAs**, one in the km class: **153814 (2001 WN5)**, and one with $d \leq 0.10$ LD: **99942 (Apophis)**).

Colour coding

green bold	asteroid, meteorite, impact site
purple bold	Potentially Hazardous Asteroid
red bold italics	spacecraft
red bold	spacecraft subsystem
blue bold	NEA related institute, observatory, organization, program
blue bold italics	NEA related conference, meeting, workshop, seminar

Sources

<https://minorplanetcenter.net/>
<https://cneos.jpl.nasa.gov/>
<https://cneos.jpl.nasa.gov/stats/totals.html>
https://ssd.jpl.nasa.gov/sbdb_query.cgi#x
<https://www.nasa.gov/planetarydefense/overview>
<https://neo.ssa.esa.int/home>
<http://neo.ssa.esa.int/close-approaches>
http://adsabs.harvard.edu/abstract_service.html
https://en.wikipedia.org/wiki/1862_Apollo
https://en.wikipedia.org/wiki/1221_Amor
https://en.wikipedia.org/wiki/2062_Aten
https://en.wikipedia.org/wiki/Atira_asteroid

- A.W. Harris, G. D'Abramo, 2015, *Icarus*, 257, 302, "The population of near-Earth asteroids."

See: <http://adsabs.harvard.edu/abs/2015Icar..257..302H>

- A.W. Harris, P. Chodas, 2021, *Icarus*, 365, 114452, "The population of near-Earth asteroids revisited and updated."

See: <https://ui.adsabs.harvard.edu/abs/2021Icar..36514452H/abstract>

- D.K. Yeomans, 2013, "Near-Earth Objects ---Finding them before they find us" (Princeton and Oxford : Princeton University Press)

See: <https://press.princeton.edu/books/hardcover/9780691149295/near-earth-objects>

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NEA CHRONOLOGY 1800 - 2200

1801 , Jan 1	First and largest asteroid discovered, 1 Ceres ($H = 3.34$ mag, $D \approx 975$ km, main-belt asteroid), by Giuseppe Piazzi (1746 – 1826, Italy) at the Osservatorio Astronomico di Palermo. Asteroid Cerere Ferdinandea was named in honour of King Ferdinand IV of Sicily, and later became known simply as Ceres. Carl Gauss developed the math to determine an accurate orbit for Ceres and published his results in November 1801. Given the definition of planets and dwarfplanets accepted by the IAU XXVI General Assembly in 2006, Ceres is considered a dwarf planet rather than an asteroid. See: Ceres - JPL , 1 Ceres - SSA https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=Ceres Ref: - G. Piazzi, 1802, <i>Della scoperta del nuovo pianeta Cerere Ferdinandea</i> (Palermo: Nella Stamperia Reale). See:

	https://archive.org/details/DellaScopertaDelNuovoPianetaCerereFerdinandea See also: http://www.space.com/12969-giant-asteroid-ceres-telescopes-skywatching.html http://en.wikipedia.org/wiki/Ceres_(dwarf_planet) More recently: Since 6 March 2015, NASA spacecraft Dawn is in orbit around Ceres . See: http://www.jpl.nasa.gov/news/news.php?feature=4503 http://www.jpl.nasa.gov/news/news.php?feature=4540
1803 , 26 Apr	L'Aigle Meteorite Fall . In the early afternoon of 26 April 1803 a meteorite shower of more than 3000 fragments fell upon the town of L'Aigle (Normandy, France). Ref: - M. Gounelle, 2003, in <i>66th Annual Meteoritical Society Meeting</i> (2003), <i>Meteoritics & Planetary Science</i> , 38, Supplement, abstract no.5251, "The meteorite fall at l'Aigle on April 26th 1803 and the Biot report." See: http://adsabs.harvard.edu/abs/2003M%26PSA..38.5251G See also: http://en.wikipedia.org/wiki/L'Aigle_(meteorite)
1807 , Dec 14	Weston Meteorite . At 6:30 hr on the morning of 14 December 1807, a blazing fireball about two-thirds the size of the Moon was seen traveling southwards by early risers in Vermont and Massachusetts (USA). Three loud explosions were heard over the town of Weston in Fairfield County, Connecticut. Stone fragments fell in at least 6 places. See: http://peabody.yale.edu/collections/meteorites-and-planetary-science/weston-meteorite http://en.wikipedia.org/wiki/Weston_meteorite
1840 , Jun 12	Uden Meteorite (Netherlands). A 0.6 kg meteorite was found. See: http://www.dwc.knaw.nl/DL/publications/PU00015500.pdf http://www.sterrenkunde.nl/index/encyclopedie/meteoren.html
1843 , Jun 2	Blauwkapel Meteorite (Netherlands). Two pieces were found, of 2.7 and 7 kg. See: http://www.dwc.knaw.nl/DL/publications/PU00015500.pdf http://www.sterrenkunde.nl/index/encyclopedie/meteoren.html
1859 , Nov 15	New York City Fireball and Airburst (USA). See: http://www.meteoritehistory.info/AJS/S2VIEWS/V30P186.HTM http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1860 , Jul 20	The Meteor Procession of 20 July 1860, visible from the Great

	Lakes to New York State (USA), continuing out over the Atlantic Ocean. Ref: - Walt Whitman, 1859-1860, in <i>Leaves of Grass</i>, "Year of Meteors."; - A.G. Pope, 5-1-2010, <i>Astronomical dating of Edvard Munch's summer sky paintings</i>, University Honors Program, Texas State University; - R. Sinnott, 2010, <i>Sky & Telescope</i>, 7 June 2010, "Walt Whitman's "Meteor-Procession"." See: http://www.skyandtelescope.com/community/skyblog/newsblog/95765719.html - D.W. Olson, R.L Doescher, M.S. Olson, A.G. Pope, 2010, <i>Sky & Telescope</i>, 120, No.1, July 2010, p. 28, "Walt Whitman's "Year of Meteors"." See: http://www.skyandtelescope.com/community/skyblog/newsblog/95765719.html http://philosophyofscienceportal.blogspot.com/2010/06/walt-whitman-wrote-about-strange-huge.html http://www.txstate.edu/news/news_releases/news_archive/2010/06/YearOfMeteors060110.html http://www.newscientist.com/gallery/whitman-mystery-solved/3 http://www.newscientist.com/blogs/culturelab/2010/06/the-forensic-astronomer-donald-olson.html http://cosmiclog.msnbc.msn.com/_news/2010/06/02/4448882-150-year-old-meteor-mystery-solved http://apod.nasa.gov/apod/ap100722.html http://en.wikipedia.org/wiki/Earth-grazing_fireball
1864, May 14	Orgueil Meteorite rain over Orgueil (Southern France). Some 20 stones fell over an area of several square kilometers, with a total weight of 14 kg. Ref: - M. Gounelle, P. Spurný, P.A. Bland, 2006, <i>Meteoritics & Planetary Science</i>, 41, 135, "The orbit and atmospheric trajectory of the Orgueil meteorite from historical records." See: http://www.springerlink.com/content/m470723364612j6x/ See also: http://en.wikipedia.org/wiki/Orgueil_(meteorite)
1868, July 11	Main-belt asteroid 100 Hekate ($H = 7.66$ mag, $D \approx 123$ km) discovered by James C. Watson (1838 – 1880) at Ann Arbor (MI, USA). 100th numbered asteroid in the data base of the IAU Minor Planet Center, Cincinnati Observatory (Ohio, USA). See: 100 Hekate - JPL , 100 Hekate - SSA See also: http://en.wikipedia.org/wiki/100_Hekate

1873 , Oct 27	Diepenveen Meteorite Fall , Diepenveen (the Netherlands). See: http://www.naturalis.nl/en/news/collectie-2/new-dutch-meteorite-fell-1873/
1890 , May 2	Forest City Meteorite Fall , Forest City (Iowa, USA), 2 May 1890. Ref: - H.H. Nininger, 1942, <i>Popular Astronomy</i> , 50, 111, "A celestial bomb." See: http://en.wikipedia.org/wiki/Meteorite_falls
1891 , Dec 22	First photographic discovery of an asteroid, 323 Brucia ($H = 9.53$ mag, $D \approx 35.8$ km), by Maximilian F.J.C. Wolf (1863 – 1932) at the Landessternwarte Heidelberg-Königstuhl (Heidelberg, Germany). See: Brucia - JPL , Brucia - SSA See also: http://en.wikipedia.org/wiki/323_Brucia
1893	G.K. Gilbert (1893) suggested impacts as most likely process for forming lunar craters. Ref: - G.K. Gilbert, 1893, <i>Bulletin of the Philosophical Society of Washington</i> , 12, 241, "The Moon's face: a study of the origin of its features." See: http://adsabs.harvard.edu/abs/1893QB591.G46.....
1896 , Feb 2	Great Madrid Meteor Event . See: http://adsabs.harvard.edu/full/1896PASP....8...86C http://en.wikipedia.org/wiki/Chelyabinsk_meteor
1898 , Aug 13	First discovery of a NEA: asteroid 433 Eros (1898 DQ , $H = 10.3$ mag, $D \approx 34.4 \times 11.2 \times 11.2$ km, orbital $P = 1.76$ yr, Amor asteroid), by Carl Gustav Witt (1866 – 1948) at the Urania Sternwarte Berlin (Germany), and independently by Auguste Charlois (1864 – 1910) at the Observatoire de Nice (France). Second-largest NEA known . Its perihelion distance of 1.133 AU brings it with 0.15 AU of the orbit of the Earth. See: 1898 DQ - JPL , 433 Eros - SSA See also: http://en.wikipedia.org/wiki/433_Eros Ref: - P. Michel, P. Farinella, Ch. Froeschlé, 1996, <i>Nature</i> , 380, 689, "The orbital evolution of the asteroid Eros and implications for collision with the Earth." See: http://adsabs.harvard.edu/abs/1996Natur.380..689M See also:

	http://www.oaa.gr.jp/~oaacs/mp/BriefHistoryofMPCbyConradBardwell.pdf See also: 23 Jan 1975, 31 Jan 2012.
1899 , Mar 12	Helsinki Fireball and Airburst (Finland). See: http://www.somerikko.net/collection/meteorites.php?id=374 http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1900 , Jan 1	1 NEA known. See: http://neo.jpl.nasa.gov/stats/
1900, Jan 4	Aten NEA 509352 (2007 AG, $H = 20.2$ mag, $D \approx 300$ m, PHA) , passed Earth at a nominal miss distance of 3.75 LD. Minimum miss distance 3.75 LD. See: 2007 AG - JPL , 2007 AG - SSA See also: 4 Jan 1919.
1900, Jan 29	Apollo NEA 4660 Nereus (1982 DB, $H = 18.3$ mag, $D \approx 510 \times 330 \times 240$ m, PHA) passed Earth at a nominal distance of 8.09 LD. Minimum distance 8.08 LD. See: 1982 DB - JPL , 4660 Nereus - SSA https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=4660 Nereus See also: http://en.wikipedia.org/wiki/4660_Nereus Ref: - M. Brozovic, S.J. Ostro, L.A.M. Benner, et al., 2009, <i>Icarus</i> , 201, 153, "Radar observations and a physical model of asteroid 4660 Nereus , a prime space mission target." See: http://adsabs.harvard.edu/abs/2009Icar..201..153B - K. Kitazato, S. Abe, M. Ishiguro, et al., October 2012, <i>AAS DPS meeting</i> #44, #210.20, "Measuring the YORP effect of asteroid 4660 Nereus ." See: http://adsabs.harvard.edu/abs/2012DPS....4421020K See also: 22 Jan 2002, 11 Dec 2021, 14 Feb 2060, 4 Feb 2071, 23 Dec 2112, 4 Feb 2166.
1900, May 10	Aten NEA 326290 Akhenaten (1998 HE3, $H = 22.0$ mag, $D \approx 100$ m, PHA) , passed Earth at a nominal miss distance of 4.01 LD. Minimum miss distance 4.01 LD. See: 1998 HE3- JPL , 1998 HE3- SSA
1900, Jul 24	Apollo NEA 2007 HE15 ($H = 20.0$ mag, $D \approx 400$ m, PHA) , passed Earth at a nominal miss distance of 3.98 LD. Minimum miss distance 3.96 LD. See: 2007 HE15 - JPL , 2007 HE15 - SSA
1901 , Jun 7	Aten NEA 2014 HQ124 ($H = 19.0$ mag, $D \approx 370$ m, PHA) , passed Earth at a nominal miss distance of 5.95 LD. Minimum miss distance

	5.92 LD. See: 2014 HQ124 - JPL , 2014 HQ124 - SSA See also: https://www.google.nl/#q=asteroid+2014+hq124 https://en.wikipedia.org/wiki/2014_HQ124 See also: 7 Jun 1952, 8 Jun 2014, 8 Jun 2065.
1901, Aug 4	Apollo NEA 2008 GO20 ($H = 22.4$ mag, $D \approx 120$ m) passed Earth at a nominal miss distance of 3.38 LD. Minimum miss distance 3.26 LD. See: 2008 GO20 – S2P , 2008 GO20 - JPL See also: https://www.space.com/asteroid-flyby-earth-size-of-giza-pyramid See also: 31 Jul 1935, 25 Jul 2021.
1901, Aug 14	Apollo NEA 2011 DS ($H = 26.8$ mag, $D \approx 15$ m), passed Earth at a nominal miss distance of 8.06 LD. Minimum miss distance 0.74 LD. See: 2011 DS - JPL , 2011 DS - SSA See also: 18 Feb 1966, 18 Feb 2050.
1902 , Mar 8	Apollo NEA 2014 QJ33 ($H = 23.7$ mag, $D \approx 70$ m), passed Earth at a nominal miss distance of 6.86 LD. Minimum miss distance 0.85 LD. See: 2014 QJ33 – S2P , 2014 QJ 33 – JPL
1902, Sep 28	Aten NEA 2021 SY3 ($H = 27.1$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 4.30 LD. Minimum miss distance 0.76 LD. See: 2021 SY3 – S2P , 2021 SY3 – JPL See also: 27 Sep 2076.
1902, Nov 19	Aten NEA 2019 OR1 ($H = 21.1$ mag, $D \approx 220$ m, PHA), passed Earth at a nominal miss distance of 3.74 LD. Minimum miss distance 3.69 LD. See: 2019 OR1 - JPL , 2019 OR1 - SSA See also: 20 Nov 2085 , 21 Nov 2100, 21 Nov 2178.
1903 , Jan 13	Apollo NEA 2010 WZ8 ($H = 20.9$ mag, $D \approx 230$ m, PHA) passed Earth at a nominal miss distance of 3.51 LD. Minimum miss distance 3.51 LD. See: 2010 WZ8 - JPL , 2010 WZ8 - SSA See also: 13 Jan 2047.
1903, Feb 18	Aten NEA 208023 (1999 AQ10), ($H = 20.6$ mag, $D \approx 280$ m, PHA), passed Earth at a nominal miss distance of 4.29 LD. Minimum miss distance 4.28 LD. See: 1999 AQ10 - JPL , 1999 AQ10 - SSA See also: 18 Feb 2009.

1903, Apr 24	Apollo NEA 2007 VG ($H = 21.4$ mag, $D \approx 190$ m, PHA) passed Earth at a nominal miss distance of 3.14 LD. Minimum miss distance 3.05 LD. See: 2007 VG - JPL , 2007 VG - SSA See also: 23 Apr 2062 .
1904, Oct 29	Apollo NEA 260141 (2004 QT24) ($H = 18.1$ mag, $D \approx 900$ m, PHA), passed Earth at a nominal miss distance of 2.30 LD. Minimum miss distance 2.29 LD. See: 2004 QT24 - JPL , 2004 QT24 - SSA
1905	C. Flammarion, 1905, <i>L'Astronomie</i> , 19, 309, "Si quelque jour la vertu disparaissait de la Terre, il serait convenable de la retrouver au ciel." See: http://gallica.bnf.fr/ark:/12148/bpt6k96408857
1905, May 14	Aten NEA 2011 AX22 ($H = 24.7$ mag, $D \approx 40$ m), passed Earth at a nominal miss distance of 5.04 LD. Minimum miss distance 0.17 LD. See: 2011 AX22 – S2P , 2011 AX22 – JPL
1905, Jun 3	Apollo NEA 2007 LU19 ($H = 21.5$ mag, $D \approx 180$ m, PHA) passed Earth at a nominal miss distance of 2.97 LD. Minimum miss distance 2.96 LD. See: 2007 LU19 - JPL , 2007 LU19 - SSA
1905, Jun 27	Apollo NEA 25143 Itokawa (1998 SF36) , ($H = 19.1$ mag, $D = 520 \times 270 \times 230$ m, $M = 3.6 \times 10^{10}$ kg, PHA) passed Earth at a nominal miss distance of 4.50 LD. Minimum miss distance 4.50 LD. See: 1998 SF36 - JPL , 25143 Itokawa - SSA See also: 26 Jun 2004, 9 Apr 2167 . See also: https://en.wikipedia.org/wiki/25143_Itokawa
1906, Jan 11	Apollo NEA 2018 YO2 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 36.68 LD. Minimum miss distance 0.38 LD. See: 2018 YO2 - SSA , 2018 YO2 - JPL See also: http://iawn.net/ See also: 28 Dec 2018 .
1906, Feb 26	Apollo NEA 2014 PW59 ($H = 21.0$ mag, $D \approx 230$ m, PHA) passed Earth at a nominal miss distance of 3.97 LD. Minimum miss distance 3.66 LD. See: 2014 PW59 - JPL , 2014 PW59 - SSA See also: 1 Mar 1947 .
1906, Apr 11	Apollo NEA 2011 UH20 ($H = 21.1$ mag, $D \approx 220$ m, PHA) passed Earth at a nominal miss distance of 4.69 LD. Minimum miss distance

	4.54 LD. See: 2011 UH20 - JPL , 2011 UH20 - SSA See also: 11 Apr 1977.
1907 , Apr 5	Apollo NEA 2005 TS15 ($H = 21.3$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 4.44 LD. Minimum miss distance 4.43 LD. See: 2005 TS15 - JPL , 2005 TS15 - SSA
1907, Apr 13	Aten NEA 99942 Apophis (2004 MN4, $H = 19.7$ mag, $D = 310 \pm 30$ m, orbital $P = 0.89$ yr, PHA) passed Earth at a nominal miss distance of 11.27 LD. Minimum miss distance 8.12 LD. See: 2004 MN4 - JPL , 99942 Apophis - SSA See also: http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis http://en.wikipedia.org/wiki/99942_Apophis See also: 14 Apr 1949, 14 Apr 1998, 13 Apr 2029, 23 Mar 2036, 11 Sep 2102, 12 Apr 2116, 7 Apr 2123.
1907, May 20	Apollo NEA 2001 SG286 ($H = 20.8$ mag, $D \approx 250$ m, PHA) passed Earth at a nominal miss distance of 2.84 LD. Minimum miss distance 2.84 LD. See: 2001 SG286 - JPL , 2001 SG286286 - SSA
1907, Dec 26	Aten NEA 2010 XC15 ($H = 21.6$ mag, $D \approx 170$ m, PHA) passed Earth at a nominal miss distance of 4.46 LD. Minimum miss distance 2.84 LD. See: 2010 XC15 - JPL , 2010 XC15 - SSA See also: https://en.wikipedia.org/wiki/2010_XC15 See also: 27 Dec 1914, 27 Dec 1976, 27 Dec 2022, 28 Dec 2059, 26 Dec 2064, 26 Dec 2096.
1908 , Jun 2	Apollo NEA 2020 KQ1 ($H = 24.2$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 4.32 LD. Minimum miss distance 0.26 LD. See: 2020 KQ1 – S2P , 2020 KQ1- JPL
1908, Jun 30	Impact. Tunguska event, Siberia (Russia). According to Boslough & Crawford (2008), possibly an asteroid with $D \approx 30 - 50$ m, exploding in an airburst with $E \approx 4$ megaton TNT at an altitude of ~ 8.5 km, flattening ~ 2000 km² of forest. Ref: - L.A. Kulik, 1938, <i>Astronomical Society of the Pacific Leaflets</i>, 3, 78, "The meteorite of June 30, 1908, in Central Siberia." See: http://adsabs.harvard.edu/abs/1938ASPL....3...78K - A. Ben-Menahem, September 1975, <i>Physics of the Earth and</i>

	<i>Planetary Interiors</i>, 11, 1, "Source parameters of the Siberian explosion of June 30, 1908, from analysis and synthesis of seismic signals at four stations." See: http://adsabs.harvard.edu/abs/1975PEPI...11....1B - L'. Kresak, 1978, <i>Bulletin Astronomical Institutes of Czechoslovakia</i>, 29, 129, "The Tunguska object – a fragment of Comet Encke?" See: http://adsabs.harvard.edu/abs/1978BAICz...29..129K - R.P. Turco, O.B. Toon, C. Park, et al., 1981, <i>Science</i>, 214, 19, "Tunguska meteor fall of 1908 – effects on stratospheric ozone." See: http://adsabs.harvard.edu/abs/1981Sci...214...19T - Z. Sekanina, 1983, <i>Astronomical Journal</i>, 88, 1382, "The Tunguska event – no cometary signature in evidence." Erratum, 1984, <i>Astronomical Journal</i>, 89, 185. See: http://adsabs.harvard.edu/abs/1983AJ.....88.1382S http://adsabs.harvard.edu/abs/1984AJ.....89..185S - C.F. Chyba, 1993, <i>Astronomy</i>, 21, no.12, p.38, "Death from the sky." See: http://adsabs.harvard.edu/abs/1993Ast....21R..38C - C.F. Chyba, P.J. Thomas, K.J. Zahnle, 7 January 1993, <i>Nature</i>, 361, 40, "The 1908 Tunguska explosion: atmospheric disruption of a stony asteroid." See: http://adsabs.harvard.edu/abs/1993Natur.361...40C - R.A. Gallant, 1994, <i>Sky & Telescope</i>, 87, no. 6, p. 38, "Journey to Tunguska." See: http://adsabs.harvard.edu/abs/1994S%26T....87...38G - P. Farinella, L. Foschini, Ch. Froeschlé, 2001, <i>Astronomy & Astrophysics</i>, 377, 1081, "Probable asteroidal origin of the Tunguska cosmic body." See: http://adsabs.harvard.edu/abs/2001A%26A...377.1081F - K. Zahnle, 1996, <i>Nature</i>, 383, 674, "Tunguska: leaving no stone unburned." See: http://www.nature.com/nature/journal/v383/n6602/pdf/383674a0.pdf - N.V. Vasilyev, Feb-Mar 1998, <i>Planetary and Space Science</i>, 46, 129, "The Tunguska Meteorite problem today." See: http://adsabs.harvard.edu/abs/1998P%26SS...46..129V - G. Longo, 2007, in: P. Bobrowsky & H. Rickman (eds.), 2007, <i>Comet/Asteroid Impacts and Human Society</i> (Berlin: Springer), p. 304, "The Tunguska event." See: http://adsabs.harvard.edu/abs/2007caih.book....B - D.I. Steel, 2008, <i>Nature</i>, 453, 1157, "Tunguska at 100." See: http://www.nature.com/news/2008/080625/full/4531157a.html - M.B.E. Boslough, D.A. Crawford, 2008, <i>Intern. J. of Impact Engineering</i>, 35, 1441, "Low-altitude airbursts and the impact threat." See: https://ui.adsabs.harvard.edu/abs/2008IJIE...35.1441B/abstract

	http://www.sandia.gov/ldrd/images/Posters/Boslough_Poster.pdf - B. Napier, D. Asher, 2009, <i>Astronomy & Geophysics</i> , 50, 1.18, "The Tunguska impact event and beyond." See: http://adsabs.harvard.edu/abs/2009A%26G....50a..18N - V. Rubtsov, 10 March 2013, e-print <i>arXiv</i> :1302.6273, "Reconstruction of the Tunguska Event of 1908: neither an asteroid, nor a comet core." See: http://adsabs.harvard.edu/abs/2013arXiv1302.6273R See also: http://www.time.com/time/photogallery/0,29307,1818757,00.html http://apod.nasa.gov/apod/ap111002.html https://sputniknews.com/analysis/20080626112250936/ https://sputniknews.com/science/201701181049718416-tunguska-event-lake-cheko/ http://en.wikipedia.org/wiki/List_of_meteor_air_bursts http://en.wikipedia.org/wiki/Tunguska_event
1908, Oct 3	Apollo NEA 2020 JN3 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 6.46 LD. Minimum miss distance 0.88 LD. See: 2020 JN3 – S2P , 2020 JN3 - JPL
1908, Dec 16	Aten NEA 33342 (1998 WT24) , $H = 18.3$ mag, $D \approx 415$ m, PHA) passed Earth at a nominal miss distance of 3.54 LD. Minimum miss distance 3.54 LD. See: 1998 WT24 - JPL , 1998 WT24 - SSA See also: http://neo.jpl.nasa.gov/images/1998wt24.html http://science.nasa.gov/science-news/science-at-nasa/2001/ast14dec_1/ http://www.jpl.nasa.gov/news/news.php?feature=4800 https://en.wikipedia.org/wiki/(33342)_1998_WT24 See also: 16 Dec 1956, 16 Dec 2001, 11 Dec 2015, 18 Dec 2099.
1909, Mar 6	Apollo NEA 474158 (1999 FA) , $H = 20.9$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal distance of 4.37 LD. Minimum distance 4.20 LD. See: 1999 FA - JPL , 1999 FA - SSA See also: 6 Mar 1999, 6 Mar 2143, 7 Mar 2194.
1909, Aug 28	Aten NEA 2016 QA2 ($H = 25.3$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 5.84 LD. Minimum miss distance 0.27 LD. See: 2016 QA2- JPL , 2016 QA2 - SSA
1910, Jan 1	1 NEA known. See: http://neo.jpl.nasa.gov/stats/
1910	Minor planet astronomy became organized in a formal way at the Rechen-Institut in Berlin-Dahlem (Germany), director Fritz Cohn

	(1878 – 1940). Ref: - G. Stracke, 1935, <i>Astronomische Nachrichten</i>, 255, 189, "25 Jahre genäherte Bearbeitung der Bahnen der Kleinen Planeten im Astronomischen Rechen-Institut." Predecessor of the MPC. See: http://adsabs.harvard.edu/abs/1935AN....255..189S See also: 1947.
1910, May 9	Aten NEA 2007 JB21 ($H = 25.8$ mag, $D \approx 25$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.16 LD. [1910-01] See: 2007 JB21 - JPL , 2007 JB21 - SSA See also: 8 May 2054.
1911, Jun 28	The Nakhla Meteorite fell to Earth on 28 June 1911 in the Nakhla region of Abu Hommos (Alexandria, Egypt). Many people witnessed its explosion in the upper atmosphere before the meteorite fell to Earth in an area of 4.5 km in diameter. About forty pieces were recovered. Recovered fragments ranged in weight from 20 to 1813 g. See: http://en.wikipedia.org/wiki/Nakhla_meteorite
1911, Sep 8	Amor NEA 719 Albert (A911 TB = 2000 JW8, $H = 15.8$ mag, $D \approx 2400$ m) passed Earth at 80 LD. Discovered by Johann Palisa (1848 – 1925), discoverer of 122 asteroids at the Vienna Observatory (Austria). Lost (the last missing), but rediscovered 1 May 2000 by Jeffrey A. Larsen with the Spacewatch Telescope in Arizona (USA). See: 2000 JW8 - JPL , 719 Albert - SSA See also: http://www.space.com/scienceastronomy/asteroid_found_000510.html http://en.wikipedia.org/wiki/719_Albert http://en.wikipedia.org/wiki/Johann_Palisa
1912, Sep 11	Apollo NEA 2001 FA58 ($H = 21.5$ mag, $D \approx 180$ m, PHA) passed Earth at a nominal miss distance of 4.60 LD. Minimum miss distance 4.60 LD. See: 2001 FA58 - JPL , 2001 FA58 - SSA
1913, Feb 9	Earth-grazing fireball. A meteor procession observed from Canada to Bermuda and beyond. Ref: - J.A. O'Keefe, 1959, <i>Journal Royal Astronomical Society of Canada</i>, 53, 59, "A probable natural satellite: the meteor procession of February 9, 1913." As of 2008, four Earth-grazing fireballs have been scientifically observed: on 10 August 1972, 13 October 1990, 29 March 2006, and

	7 August 2007. See: http://adsabs.harvard.edu/abs/1959JRASC..53...59O http://en.wikipedia.org/wiki/Earth-grazing_fireball
1913, Mar 6	Apollo NEA 2009 EH1 ($H = 27.8$ mag, $D \approx 10$ m), passed Earth at a nominal miss distance of 5.12 LD. Minimum miss distance 0.84 LD. See: 2009 EH1 – S2P , 2009 EH1 – JPL
1913, Apr 2	Apollo NEA 2020 GY1 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 9.67 LD. Minimum miss distance 0.83 LD. See: 2020 GY1 – S2P , 2020 GY1 - JPL See also: 5 Apr 2020 , 5 Apr 2033 .
1913, Sep 30	Apollo NEA 2012 GV17 ($H = 20.1$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 2.18 LD. Minimum miss distance 2.06 LD. See: 2012 GV17 - JPL , 2012 GV17 - SSA
1914 , Mar 09	Apollo NEA 2016 CY135 ($H = 24.5$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 1.16 LD. Minimum miss distance 0.81 LD. See: 2016 CY135 - JPL , 2016 CY135- SSA See also: 11 Mar 2068 .
1914, Oct 29	Apollo NEA 69230 Hermes (1937 UB , $H = 17.5$ mag, $D \approx 1100$ m, PHA) passed Earth at a nominal distance of 9.71 LD. Minimum distance 9.67 LD. Discovered by Karl W. Reinmuth (1892 – 1979) at the Landessternwarte Heidelberg-Königstuhl (Heidelberg, Germany); lost; recovered 15 October 2003. Arecibo radar observations on the same day revealed it to be a binary asteroid, with components of $D \approx 400$ m, separated by 1200 m. See: 1937 UB - JPL , 69230 Hermes - SSA See also: http://science.nasa.gov/headlines/y2003/31oct_hermes.htm http://www.news.cornell.edu/releases/Oct03/Arecibo.asteroid.deb.html http://adsabs.harvard.edu/abs/2003IAUC.8227....2M http://en.wikipedia.org/wiki/69230_Hermes See also: 30 Oct 1937 , 26 Apr 1942 , 1 Nov 1954 , 31 Oct 2086 , 30 Apr 2123 .
1914, Dec 17	Apollo NEA 2017 YE ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 5.71 LD. Minimum miss distance 0.36 LD. See: 2017 YE - JPL , 2017 YE - SSA
1914, Dec 27	Aten NEA 2010 XC15 ($H = 21.6$ mag, $D \approx 170$ m, PHA) passed Earth at a nominal miss distance of 1.99 LD. Minimum miss distance 1.94 LD.

	See: 2010 XC15 - JPL , 2010 XC15 - SSA See also: 26 Dec 1907, 27 Dec 1976, 27 Dec 2022, 28 Dec 2059, 26 Dec 2064, 26 Dec 2096. See also: https://en.wikipedia.org/wiki/2010_XC15
1914, Dec 31	Apollo NEA 152680 (1998 KJ9), $H = 19.4$ mag, $D \approx 500$ m, PHA) passed Earth at a nominal miss distance of 0.61 LD. Minimum miss distance 0.60 LD. [1914-01] See: 1998 KJ9 - JPL , 152680 1998 KJ9 - SSA See also: http://en.wikipedia.org/wiki/(152680)_1998_KJ9
1915, May 15	Apollo NEA 2000 SL10 ($H = 22.5$ mag, $D \approx 110$ m, PHA) passed Earth at a nominal miss distance of 4.41 LD. Minimum miss distance 3.86 LD. See: 2000 SL10 - JPL , 2000 SL10 - SSA See also: 14 May 2029.
1915, Aug 8	Aten NEA 2018 MD7 ($H = 22.6$ mag, $D \approx 110$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.23 LD. [1915-01] See: 2018 MD7 - JPL , 2018 MD7 - SSA
1915, Sep 10	Apollo NEA 2010 RF12 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 1.22 LD. Minimum miss distance 1.10 LD. See: 2010 RF12 - JPL , 2010 RF12 - SSA See also: http://en.wikipedia.org/wiki/2010_RF12 See also: 8 Sept 2010, 5 Sep 2095.
1916, Mar 12	Apollo NEA 216985 (2000 QK130), $H = 21.3$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 6.98 LD. Minimum miss distance 5.98 LD. See: 2000 QK130 - JPL , 2000 QK130 - SSA See also: 14 Mar 1968, 15 Mar 2036, 15 Mar 2089.
1917, Oct 4	Apollo NEA 2008 TC3 ($H = 30.3$ mag, $D \approx 4.1$ m) passed Earth at a nominal miss distance of 6.80 LD. Minimum miss distance 1.06 LD. See: 2008 TC3 - JPL , 2008 TC3 - SSA See also: https://en.wikipedia.org/wiki/2008_TC3 See also: 11 Oct 1961, 2 Oct 1971, 27 Jan 1988, 6 Oct 2008.
1918, Feb 17	Aten NEA 367943 Duende (2012 DA14), $H = 24.2$ mag, $D \approx 40 \times 20$ m), discovered in 2012 by the Spanish Observatorio Astronómico de la Sagra, passed Earth at a nominal miss distance of 1.13 LD.

	Minimum miss distance 1.13 LD. See: 2012 DA14 - JPL , 367943 Duende - SSA See also: https://en.wikipedia.org/wiki/367943_Duende See also: 19 Aug 2004, 16 Feb 2012, 15 Feb 2013, 15 Feb 2046, 15 Feb 2087.
1918, Mar 29	Aten NEA 2017 FY101 ($H = 27.2$ mag, $D \approx 13$ m), passed Earth at a nominal miss distance of 1.77 LD. Minimum miss distance 0.23 LD. See: 2017 FY101 – S2P , 2017 FY101 – JPL
1918, Sep 17	Apollo NEA 458732 (2011 MD5, $H = 17.8$ mag, $D \approx 1000$ m, PHA) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [1918-01] See: 2011 MD5 - JPL , 2011 MD5 - SSA
1919 , Jan 4	Aten NEA 509352 (2007 AG, $H = 20.2$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 1.95 LD. Minimum miss distance 1.95 LD. See: 2007 AG - JPL , 2007 AG - SSA See also: 4 Jan 1900.
1919, May 15	Aten NEA 2019 JH7 ($H = 29.7$ mag, $D \approx 4$ m), passed Earth at a nominal miss distance of 7.44 LD. Minimum miss distance 0.21 LD. See: 2019 JH7 – S2P , 2019 JH7 – JPL
1919, Nov 26	Michigan - Indiana Fireball and Airburst (USA). See: http://chroniclingamerica.loc.gov/lccn/sn84026749/1919-11-27/ed-1/seq-1/ http://neo.ssa.esa.int/newsletters (5 November 2019) http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1919, Dec 21	Amor NEA 2015 JQ1 ($H = 20.5$ mag, $D \approx 280$ m) passed Earth at a nominal miss distance of 9.84 LD. Minimum miss distance 0.23 LD. See: 2015 JQ1 - JPL , 2015 JQ1 - SSA
1920 , Jan 1	3 NEAs known, of which 0 PHAs. See: http://neo.jpl.nasa.gov/stats/
1920, Feb 10	Apollo NEA 2019 CB2 ($H = 26.1$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 5.30 LD. Minimum miss distance 0.78 LD. See: 2019 CB2 - SSA , 2019 CB2 - JPL
1920, Jun 20	Apollo NEA 2017 MF ($H = 26.4$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 1.14 LD. Minimum miss distance 0.33 LD. See: 2017 MF - SSA , 2017 MF - JPL See also: 19 Jun 2017.

1920, Dec 13	Apollo NEA 2016 WJ1 ($H = 21.4$ mag, $D \approx 180$ m, PHA) passed Earth at a nominal miss distance of 4.49 LD. Minimum miss distance 4.36 LD. See: 2016 WJ1 - JPL , 2016 WJ1 - SSA See also: 14 Dec 2061 , 14 Dec 2097 .
1920, Dec 19	Apollo NEA 2015 YQ1 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 8.71 LD. Minimum miss distance 0.26 LD. See: 2015 YQ1- SSA , 2015 YQ1 - JPL
1921	Alfred Wegener (1880 – 1930, Germany), 1921, <i>Die Entstehung der Mondkrater</i> (Braunschweig: Friedrich Vieweg & Sohn). Translation: A. Wegener, 1975, <i>The Moon</i> , 4, 211, "The origin of lunar craters." See: http://adsabs.harvard.edu/abs/1975Moon...14..211W
1921, Oct 20	Apollo NEA 2340 Hathor (1976 UA , $H = 20.5$ mag, $D \approx 210$ m, PHA) passed Earth at a nominal miss distance of 3.82 LD. Minimum miss distance 3.82 LD. See: 1976 UA - JPL , 1976 UA - SSA See also: 20 Oct 1976 , 21 Oct.2069 , 21 Oct 2086 .
1922 , Jun 7	Apollo NEA 2017 LD ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.025 LD (= 1.50 R_{Earth} from the geocenter) . [1922-01] See: 2017 LD - SSA , 2017 LD - JPL
1922, Oct 24	Aten NEA 2021 UO1 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 4.56 LD. Minimum miss distance 0.87 LD. See: 2021 UO1 – S2P , 2021 UO1 - JPL See also: 25 Oct 2021 , 25 Oct 2029 .
1923	Discovery of asteroid 1000 Piazzia (1923 NZ , ($H = 10.6$ mag, $D = 27$ km, Main-belt asteroid), by Karl W. Reinmuth (1892 – 1979) at the Landessternwarte Heidelberg-Königstuhl in Heidelberg (Germany). Upon his proposal, the IAU named the asteroid 1000 Piazzia , being the 1000th documented asteroid, in honour of Giuseppe Piazzi who discovered asteroid Ceres in 1801. See: 1923 NZ - JPL , 1000 Piazzia - SSA See also: http://en.wikipedia.org/wiki/1000_Piazzia Ref: - B. Asplind, 1926, <i>Astronomische Nachrichten</i> , 228, 89, "Benennung der Planeten 1000 – 1002." See: http://adsabs.harvard.edu/abs/1926AN....228...89A

1923, Jun 26	Aten NEA 2021 MK1 ($H = 21.3$ mag, $D \approx 190$ m, PHA) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.71 LD. [1923-01] See: 2021 MK1 – S2P , 2021 MK1 - JPL
1924, Jan 8	Aten NEA 2021 LF6 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 8.55 LD. Minimum miss distance 0.80 LD. See: 2021 LF6 – S2P , 2021 LF6 – JPL See also: 22 Dec 1972 .
1924, Jun 5	Aten NEA 163348 (2002 NN4) , $H = 20.3$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 4.49 LD. Minimum miss distance 4.48 LD. See: 2002 NN4- JPL , 2002 NN4 - SSA See also: 6 Jun 1965 , 6 Jun 2070 , 7 Jun 2130 .
1924, Aug 22	Apollo NEA 513126 (1998 QP) , $H = 21.6$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 4.25 LD. Minimum miss distance 4.25 LD. See: 1998 QP - JPL , 1998 QP - SSA See also: 23 Aug 1998 .
1924, Sep 27	Apollo NEA 2003 SR84 ($H = 25.9$ mag, $D \approx 29$ m) passed Earth at a nominal miss distance of 1.67 LD. Minimum miss distance 0.10 LD. See: 2003 SR84 - JPL , 2003 SR84 - SSA
1924, Oct 23	Discovery of Amor NEA 1036 Ganymed (A924 UB) , $H = 9.45$, $D = 36.5$ km, orbital $P = 4.34$ yr), by W.H. Walter Baade at Hamburg-Bergedorf Observatory (Germany). Largest known NEA . In 1998, Arecibo radar images revealed a near spherical object. See: 1924 TD - JPL , 1036 Ganymed - SSA See also: http://en.wikipedia.org/wiki/1036_Ganymed Ref: - G. Hahn, P. Magnusson, A.W. Harris, et al., 1989, <i>Icarus</i> , 78, 363, "Physical studies of Apollo-Amor asteroids - <i>UBVRI</i> photometry of 1036 Ganymed and 1627 Ivar ." See: http://adsabs.harvard.edu/abs/1989Icar...78..363H - P. Michel, R. Gonczi, P. Farinella, Ch. Froeschlé, 1999, <i>Astronomy & Astrophysics</i> , 347, 711, "Dynamical evolution of 1036 Ganymed , the largest near-Earth asteroid." See: http://adsabs.harvard.edu/abs/1999A%26A...347..711M - S.K. Fieber-Beyer, M.J. Gaffey, P.A. Abell, 2011, <i>Icarus</i> , 212, 149, "Mineralogical characterization of Near Earth Asteroid (1036) Ganymed . See: http://adsabs.harvard.edu/abs/2011Icar..212..149F

1924, Dec 20	Aten NEA 2020 XY4 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 1.59 LD. Minimum miss distance 0.03 LD. See: 2020 XY4 – S2P , 2020 XY4 – JPL See also: 21 Dec 1958 .
1925, Aug 28	Ellemeet Meteorite . Whit aloud noise, so that horses and cows took fright, this meteorite fell down in a meadow near Ellemeet, on the island of Schouwen (the Netherlands) on 28 August 1925, about 11:30 hr a.m. See: http://www.sterrenkunde.nl/index/encyclopedie/meteoren.html Ref: - A.A. Nijland, 1927, <i>Hemel en Dampkring</i> , 1927, 187, "Een merkwaardige meteorsteen." - W. Nieuwenkamp, 1927, <i>Proc. Koninklijke Nederlandse Academie van Wetenschappen</i> , 1927, 724, "The Meteorite of Ellemeet (after that of Uden in 1840, and that of Blauwkapel in 1843, the third known in the Netherlands)." See: http://www.dwc.knaw.nl/DL/publications/PU00015500.pdf
1925, Aug 30	Apollo NEA 163132 (2002 CU11) , $H = 18.7$ mag, $D \approx 460$ m, PHA) passed Earth at a nominal miss distance of 0.90 LD. Minimum miss distance 0.90 LD. [1925-01] See: 2002 CU11 - JPL , 163132 2002 CU11 - SSA See also: https://en.wikipedia.org/wiki/(163132)_2002_CU11 See also 31 Aug 2080 .
1926, Nov 29	Apollo NEA 2015 XG55 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 7.61 LD. Minimum miss distance 0.92 LD. See: 2015 XG55 – SSA , 2015 XG55 – JPL
1927, Mar 14	Apollo NEA 275677 (2000 RS11) , $H = 19.0$ mag, $D \approx 600$ m, PHA) passed Earth at a nominal miss distance of 3.15 LD. Minimum miss distance 3.15 LD. See: 2000 RS11 - JPL , 2000 RS11 - SSA See also: 13 Mar 1940 .
1928, Jan 23	Apollo NEA 2010 XC25 ($H = 21.1$ mag, $D \approx 210$ m, PHA) passed Earth at a nominal miss distance of 2.33 LD. Minimum miss distance 2.19 LD. See: 2010 XC25 - JPL , 2010 XC25 - SSA
1928, Apr 25	Aten NEA 2011 DV ($H = 20.5$ mag, $D \approx 280$ m, PHA) passed Earth at a nominal miss distance of 2.31 LD. Minimum miss distance 1.06 LD. See: 2011 DV - JPL , 2011 DV - SSA

	See also: 25 Apr 2120 .
1928, Nov 20	Apollo NEA 2005 LW3 ($H = 21.7$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 4.17 LD. Minimum miss distance 4.16 LD. See: 2005 LW3 - JPL , 2005 LW3 - SSA See also: 23 Nov 2022 , 22 Nov 2084 .
1929 , Mar 16	Aten NEA 2021 FC ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 6.30 LD. Minimum miss distance 0.50 LD. See: 2021 FC – S2P , 2021 FC – JPL
1929, Apr 4	Apollo NEA 2007 SQ6 ($H = 22.0$ mag, $D \approx 140$ m, PHA) passed Earth at a nominal miss distance of 4.46 LD. Minimum miss distance 3.72 LD. See: 2007 SQ6 - JPL , 2007 SQ6 - SSA See also: 3 Apr 2072 .
1929, Nov 1	Apollo NEA 2016 VP1 ($H = 27.3$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 6.88 LD. Minimum miss distance 0.64 LD. See: 2016 VP1 - JPL , 2016 VP1 - SSA See also: 2 Nov 2075 .
1930 , Jan 1	5 NEAs known, of which 0 PHAs . See: http://neo.jpl.nasa.gov/stats/
1930, Jan 29	Apollo NEA 2018 BT6 ($H = 21.4$ mag, $D \approx 180$ m, PHA) passed Earth at a nominal miss distance of 3.72 LD. Minimum miss distance 3.72 LD. See: 2018 BT6 - JPL , 2018 BT6 - SSA
1930, May 13	Aten NEA 2011 AX22 ($H = 24.9$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 5.07 LD. Minimum miss distance 0.19 LD. See: 2011 AX22 - JPL , 2011 AX22 - SSA See also: 13 May 2055 .
1930, Jul 27	Apollo NEA 2014 SP142 ($H = 21.8$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 4.38 LD. Minimum miss distance 1.02 LD. See: 2014 SP142 - JPL , 2014 SP142 - SSA See also: 27 Jul 1984 .
1930, Aug 13	Curuçá Fireball and Airburst over Rio Curuçá (Amazonas, Brazil). Coinciding with the annual Perseid meteor shower. See: http://www.uh.edu/engines/epi1102.htm http://en.wikipedia.org/wiki/List_of_meteor_air_bursts

	Ref: - N. Vasilyev, G. Andreev, 1989, <i>WGN, the Journal of the International Meteor Organization</i>, 17, 245, "The Brazilian twin of the Tunguska Meteorite: myth or reality?" See: http://adsabs.harvard.edu/abs/1989JIMO...17..245V - M.E. Bailey, D.J. Markham, S. Massai, J.E. Scriven, 1995, <i>The Observatory</i>, 115, 250, "The 1930 August 'Brazilian Tunguska' Event." See: http://adsabs.harvard.edu/abs/1995Obs...115..250B - D. Steel, 1995, <i>WGN, the Journal of the International Meteor Organization</i>, 23, 207, "Two 'Tunguskas' in South America in the 1930's?" See: http://adsabs.harvard.edu/abs/1995JIMO...23..207S - W. Napier, D. Asher, 2009, <i>Astronomy & Geophysics</i>, 50, 1.18, "The Tunguska impact event and beyond." See: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-4004.2009.50118.x/abstract - G. Cordero, A. Poveda, 2011, <i>Planetary and Space Science</i>, 59(1), 10, "Curuça 1930: A probable mini-Tunguska?" See: http://adsabs.harvard.edu/abs/2011P%26SS...59...10C
1930, Oct 3	Apollo NEA 2016 TH ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 4.35 LD. Minimum miss distance 0.80 LD. See: 2016 TH - JPL , 2016 TH - SSA
1931, Feb 1	Apollo NEA 2020 BX12 ($H = 20.7$ mag, $D \approx 260$ m, PHA) passed Earth at a nominal miss distance of 3.47 LD. Minimum miss distance 3.46 LD. See: 2020 BX12 – S2P , 2020 BX12 - JPL
1931, Feb 7	Apollo NEA 2008 PF1 ($H = 21.2$ mag, $D \approx 210$ m, PHA) passed Earth at a nominal miss distance of 2.48 LD. Minimum miss distance 2.48 LD. See: 2008 PF1 – SSA , 2008 PF1 – JPL
1931, May 8	Apollo NEA 2008 JP24 ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 1.71 LD. Minimum miss distance 0.32 LD. See: 2008 JP24 - JPL , 2008 JP24 - SSA
1931, Jun 7	Apollo NEA 2019 LZ4 ($H = 24.6$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 4.91 LD. Minimum miss distance 0.23 LD. See: 2019 LZ4 - JPL , 2019LZ4 - SSA
1931, Sep 7	Aten NEA 2010 RX30 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 9.65 LD. Minimum miss distance 9.59 LD. See: 2010 RX30 - JPL , 2010 RX30 -SSA See also:

	http://en.wikipedia.org/wiki/2010_RX30 See also: 8 Sep 2010 .
1932, Jan 8	Aten NEA 2021 AD4 ($H = 25.7$ mag, $D \approx 26$ m) passed Earth at a nominal miss distance of 1.21 LD. Minimum miss distance 0.14 LD. See: 2021 AD4 – S2P , 2021 AD4 – JPL
1932, Feb 3	Aten NEA 2014 BW32 ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 6.23 LD. Minimum miss distance 0.86 LD. See: 2014 BW32 - JPL , 2014 BW32 - SSA
1932, Mar 12	Discovery by Eugène Delporte (1882 – 1955) on 12 March 1932 at the Uccle Observatory (Brussels, Belgium) of asteroid 1221 Amor (1932 EA1 , $H = 17.5$ mag, $D \approx 1100$ m) as an Earth-orbit approaching asteroid. Since then Amor is the namesake of the Amor asteroids. See: 1932 EA1 - JPL , 1221 Amor - SSA See also: http://en.wikipedia.org/wiki/1221_Amor
1932, Apr 24	Discovery by Karl W. Reinmuth (1892 – 1979), on 24 April 1932 at the Landessternwarte Heidelberg-Königstuhl (Heidelberg, Germany) of asteroid 1862 Apollo (1932 HA , $H = 16.2$ mag, $D \approx 1400$ m, PHA) as an Earth-orbit crossing asteroid. Since then Apollo is the namesake of the Apollo asteroids. See: 1932 HA - JPL , 1862 Apollo - SSA See also: http://en.wikipedia.org/wiki/1862_Apollo Ref: - M. Davidson, 1932, <i>Monthly Notices Roy. Astron. Soc.</i> , 92, 691, "The Reinmuth object ." See: http://adsabs.harvard.edu/abs/1932MNRAS..92..691D - L.A. Lebofsky, G.J. Veeder, G.H. Rieke, et al., 1981, <i>Icarus</i> , 48, 335, "The albedo and diameter of 1862 Apollo ." See: http://adsabs.harvard.edu/abs/1981Icar...48..335L
1932, Sep 25	Apollo NEA 2020 SP6 ($H = 26.4$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 7.88 LD. Minimum miss distance 0.0079 LD = 0.47 R_{Earth} from the geocenter . See: 2020 SP6 – S2P , 2020 SP6 – JPL
1932, Oct 21	Apollo NEA 2012 CU ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 2.83 LD. Minimum miss distance 0.73 LD. See: 2012 CU - JPL , 2012 CU - SSA
1932, Dec	In December 1932, scientists surveying the southern Egyptian desert

	came upon pieces of a translucent, pale yellow-green, glassy substance, from tiny fragments to football-sized chunks, scattered over a huge area at the Libyan border. Known as Libyan desert glass, this almost pure silica contained isotopes showing it to be of extraterrestrial origin. Further reading: see 3 March 2006. See: http://www.sciencemag.org/cgi/content/summary/311/5765/1223c See also: http://www.wits.ac.za/newsroom/newsitems/201310/21649/news_item_21649.html http://en.wikipedia.org/wiki/Libyan_desert_glass
1932, Dec 8	Arroyomolinos de León Fireball and Airburst (Spain). See: http://www.lpi.usra.edu/meetings/lpsc2011/pdf/1368.pdf http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1932, Dec 22	Aten NEA 2020 YB ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 6.43 LD. Minimum miss distance 0.34 LD. See: 2020 YB – S2P , 2020 YB – JPL
1933, Jan 3	Apollo NEA 2017 XT61 ($H = 23.1$ mag, $D \approx 80$ m) passed Earth at a nominal miss distance of 1.31 LD. Minimum miss distance 0.18 LD. See: 2017 XT61 - JPL , 2017 XT61 - SSA
1933, Jan 17	Apollo NEA 7482 (1994 PC1), $H = 16.7$ mag, $D \approx 1300$ m, PHA) passed Earth at 2.93 LD. Minimum miss distance 2.93 LD. See: 1994 PC1 -JPL , 7482 1994 PC1 - SSA See also: 18 Jan 2022. See also: https://en.wikipedia.org/wiki/(7482)_1994_PC1
1933, Oct 22	Apollo NEA 2015 UM52 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.66 LD. Minimum miss distance 0.47 LD. [1933-01] See: 2015 UM52 - JPL , 2015 UM52 - SSA See also: 22 Oct 2015.
1933, Dec 13	Apollo NEA 2010 MU112 ($H = 20.9$ mag, $D \approx 599$ m, PHA) passed Earth at a nominal miss distance of 3.19 LD. Minimum miss distance 3.19 LD. See: 2010 MU112 - JPL , 2010 MU112 - SSA See also: 13 Dec 2082.
1934, Feb 10	Discovery of Apollo NEA 1934 CT and promptly lost. Re-discovered on 4 January 1989 and listed as 1989 AC = 4179 Toutatis

	($H = 15.3$ mag, $D \approx 4750 \times 1950$ m) See: 1934 CT - JPL , 4179 Toutatis - SSA See also: http://en.wikipedia.org/wiki/4179_Toutatis See: 4 Jan 1989.
1934, Apr 20	Apollo NEA 2014 SM143 ($H = 20.4$ mag, $D \approx 290$ m, PHA) passed Earth at a nominal miss distance of 3.63 LD. Minimum miss distance 3.62 LD. See: 2014 SM143 - JPL , 2014 SM143 - SSA See also: 19 Apr 2093, 23 Oct 2197.
1934, May 3	Apollo NEA 2011 JV10 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 2.44 LD. Minimum miss distance 1.00 LD. See: 2011 JV10 - JPL , 2011 JV10 - SSA
1934, Sep 22	Aten NEA 2013 RG74 ($H = 23.3$ mag, $D \approx 80$ m) passed Earth at a nominal miss distance of 8.97 LD. Minimum miss distance 0.84 LD. See: 2013 RG74 - JPL , 2013 RG74 - SSA
1935 , Feb 8	Apollo NEA 2018 CN2 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 6.94 LD. Minimum miss distance 0.78 LD. See: 2018 CN2 - SSA , 2018 CN2 - JPL See also: 9 Feb 2018, 9 Feb 2088.
1935, Mar 8	Apollo NEA 2015 DD54 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 0.48 LD. Minimum miss distance 0.48 LD. [1935-01] See: 2015 DD54 - JPL , 2015 DD54 - SSA
1935, Apr	G. Stracke, 1935, <i>Astronomische Nachrichten</i>, 255, 189, "25 Jahre genäherte Bearbeitung der Bahnen der Kleinen Planeten im Astronomischen Rechen-Institut." Predecessor of the Minor Planet Center. At the time 1301 minor planets were numbered. See: http://adsabs.harvard.edu/abs/1935AN....255..189S
1935, May 13	Apollo NEA 2018 JP ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 8.22 LD. Minimum miss distance 0.99 LD. See: 2018 JP- S2P , 2018 JP- JPL
1935, Jul 20	Apollo NEA 2016 FG60 ($H = 21.7$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 5.08 LD. Minimum miss distance 4.88 LD. See: 2016 FG60 - JPL , 2016 FG60 - SSA
1935, Aug 4	Apollo NEA 2008 GO20 ($H = 22.4$ mag, $D \approx 120$ m) passed Earth at a nominal miss distance of 4.82 LD. Minimum miss distance 4.82

	LD. See: 2008 GO20 – S2P , 2008 GO20 - JPL See also: https://www.space.com/asteroid-flyby-earth-size-of-giza-pyramid See also: 4 Aug 1901, 25 Jul 2021.
1935, Oct 6	Apollo NEA 2020 SP6 ($H = 26.4$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 1.57 LD. Minimum miss distance 0.99 LD. See: 2020 SP6 – S2P , 2020 SP6 – JPL
1935, Dec 11	Rupununi Fireball and Airburst over Rupununi (British Guyana), near the date of the peak of the annual Geminid meteor shower. Ref: - D. Steel, 1995, <i>WGN, the Journal of the International Meteor Organization</i>, 23, 207, "Two 'Tunguskas' in South America in the 1930's?" See: http://adsabs.harvard.edu/abs/1995JIMO...23..207S - W. Napier, D. Asher, 2009, <i>Astronomy & Geophysics</i>, 50, 1.18, "The Tunguska impact event and beyond." See: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-4004.2009.50118.x/abstract
1936	F. Watson, 1936, <i>Popular Astronomy</i>, 44, 2, "Meteor craters." See: http://adsabs.harvard.edu/abs/1936PA.....44....2W
1936	F. Watson, E.M. Cook, 1936, <i>Popular Astronomy</i>, 44, 131, "The detonating Fireball of May 26, 1935." See: http://adsabs.harvard.edu/abs/1936PA.....44..131W
1936, Jan 6	Apollo NEA 2010 VB1 ($H = 23.5$ mag, $D \approx 70$ m) passed Earth at a nominal miss distance of 0.55 LD. Minimum miss distance 0.55 LD. [1936-01] See: 2010 VB1 - JPL , 2010 VB1 - SSA See also: 7 Jan 2086.
1936, Feb 7	Second discovery of an Earth-orbit crossing Apollo NEA: asteroid 2101 Adonis (1936 CA, $H = 18.4$ mag, $D \approx 880$ m, PHA), by Eugene Delporte (1872 – 1955, Belgium). Nominal miss distance of 5.77 LD. Minimum miss distance 5.77 LD. Subsequently lost; recovered in 1977. See: 1936 CA - JPL , 2101 Adonis - SSA See also: http://en.wikipedia.org/wiki/2101_Adonis
1936, Feb 14	Apollo NEA 2021 CA6 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 1.89 LD. Minimum miss distance 0.22 LD. See: 2021 CA6 – S2P , 2021 CA6 – JPL

	See also: 13 Feb 2021, 12 Feb 2054.
1936, Apr 15	Apollo NEA 2015 GA1 ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 8.14 LD. Minimum miss distance 0.42 LD. See: 2015 GA1 - JPL , 2015 GA1 - SSA
1937	F.G. Watson, H. Shapley, 1937, <i>Annals of the Astronomical Observatory of Harvard College</i> , 105, no. 32, <i>The Observatory</i> , p. 623. See: http://adsabs.harvard.edu/abs/1937AnHar.105..623W
1937, Oct 30	Apollo NEA 69230 Hermes (1937 UB , $H = 17.5$ mag, $D \approx 1100$ m, PHA) passed Earth at 1.93 LD. Minimum miss distance 1.93 LD. Discovered by Karl W. Reinmuth (1892 – 1979) at the Landessternwarte Heidelberg-Königstuhl (Heidelberg, Germany); lost; recovered 15 October 2003. Arecibo radar observations on the same day revealed it to be a binary asteroid, with components of $D \approx 400$ m, separated by 1200 m. See: 1937 UB - JPL , 69230 Hermes - SSA See also: http://science.nasa.gov/headlines/y2003/31oct_hermes.htm http://www.news.cornell.edu/releases/Oct03/Arecibo.asteroid.deb.html http://adsabs.harvard.edu/abs/2003IAUC.8227....2M http://en.wikipedia.org/wiki/69230_Hermes See also: 29 Oct 1914, 26 Apr 1942, 1 Nov 1954, 31 Oct 2086, 30 Apr 2123.
1937, Nov 17	Apollo NEA 2020 VT4 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 9.46 LD. Minimum miss distance 1.003 LD. See: 2020 VT4 – S2P , 2020 VT4 – JPL See also: 13 Nov 2020. See also: https://en.wikipedia.org/wiki/2020_VT4
1938 , Jan 09	Apollo NEA 332446 (2008 AF4 , $H = 19.7$ mag, $D \approx 400$ m, PHA) passed Earth at 2.19 LD. Minimum miss distance 2.19 LD. See: 2008 AF4 - JPL , 2008 AF4 - SSA See also: https://en.wikipedia.org/wiki/(332446)_2008_AF4
1938, Mar 11	Apollo NEA 2013 FA8 ($H = 21.3$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 1.43 LD. Minimum miss distance 1.42 LD. See: 2013 FA8 - JPL , 2013 FA8 - SSA
1938, Jun 1	Apollo NEA 2017 KW31 ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at

	a nominal miss distance of 8.31 LD. Minimum miss distance 0.51 LD. See: 2017 KW31 - JPL , 2017 KW31 - SSA
1938, Jun 2	Aten NEA 437844 (1999 MN, $H = 20.8$ mag, $D \approx 250$ m, PHA) passed Earth at a nominal miss distance of 2.37 LD. Minimum miss distance 2.37 LD. See: 1999 MN - JPL , 1999 MN - SSA See also: 2 Jun 1943, 4 Jun 2110, 4 Jun 2137, 3 Jun 2148.
1938, Jun 21	Aten NEA 2018 RW ($H = 30.5$ mag, $D \approx 2.8$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.05 LD. [1938-01] See: 2018 RW - SSA , 2018 RW - JPL See also: 8 Sep 2018.
1938, Jun 24	Chicora meteoroid. A meteoroid exploded as it entered the atmosphere above Chicora (PA, USA) on June 24, 1938. Based on the size of the explosion, the rock's initial mass (before it broke up) may have been more than 450 tons. However, only scant pieces of the meteorite were ever found – located miles away from where the main mass, missing to this day, is thought to have landed. Several reports on the Chicora meteorite mention that an unsuspecting cow was struck and injured by one falling shard; other accounts say that the poor animal was killed. See: http://www.lifeslittlemysteries.com/1535-when-space-attacks-6-craziest-meteor-impacts-history.html http://en.wikipedia.org/wiki/Chicora,_Pennsylvania#Chicora_Meteor http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1938, Nov 2	Aten NEA 2016 VA ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.42 LD. [1938-02] See: 2016 VA - SSA , 2016 VA - JPL See also: 2 Nov 2016, 1 Nov 2024.
1938, Nov 18	Apollo NEA 496816 (1989 UP, $H = 20.7$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 2.02 LD. Minimum miss distance 2.02 LD. See: 1989 UP - JPL , 1989 UP - SSA
1939 , Mar 3	Apollo NEA 2021 QW, $H = 23.3$ mag, $D \approx 80$ m) passed Earth at a nominal miss distance of 6.22 LD. Minimum miss distance 0.09 LD. See: 2021 QW – S2P , 2021 QW – JPL
1939, May 4	Apollo NEA 394130 (2006 HY51, $H = 17.1$ mag, $D = 1218 \pm 228$ m)

	passed Earth at a nominal miss distance of 63.27 LD. Minimum miss distance 63.24 LD. See: 2006 HY 51 – SSA , 2006 HY51 – JPL See also : 15 May 1985. See also : https://en.wikipedia.org/wiki/(394130)_2006_HY51 Eccentricity: 0.9695. Mercury, Venus, Earth, Mars, Jupiter crosser.	0.9
1939, May 30	Apollo NEA 2012 KP24 ($H = 26.2$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 5.40 LD. Minimum miss distance 0.66 LD. See: 2012 KP24 - JPL , 2012 KP24 - SSA See also: https://en.wikipedia.org/wiki/2012_KP24 See also: 28 May 2012.	
1940 , Jan 1	9 NEAs known, of which 3 PHAs. See: http://neo.jpl.nasa.gov/stats/	
1940	F. Watson, 1940, <i>Journal of the Royal Astronomical Society of Canada</i>, 34, 418, "The meteor of May 7, 1928." See: http://adsabs.harvard.edu/abs/1940JRASC..34..418W	
1940, Feb 15	Aten NEA 2020 CL1 ($H = 20.0$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 8.88 LD. Minimum miss distance 5.50 LD. See: 2020 CL1 – S2P , 2020 CL1 – JPL See also: 15 Feb 1991, 15 Feb 2036, 14 Feb 2081, 16 Feb 2118.	
1940, Mar 13	Apollo NEA 275677 (2000 RS11), ($H = 19.0$ mag, $D \approx 600$ m, PHA) passed Earth at 4.11 LD. Minimum miss distance 4.11 LD. See: 2000 RS11 - JPL , 2000 RS11 - SSA See also: 14 Mar 1927.	
1940, May 29	Apollo NEA 2018 LE1 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 3.27 LD. Minimum miss distance 0.39 LD. See: 2018 LE1 - JPL , 2018 LE1 - SSA	
1940, Sep 16	Apollo NEA 2007 RJ1 ($H = 25.3$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.60 LD. [1940-01] See: 2007 RJ1 – S2P , 2007 RJ1 – JPL	
1941	F.G. Watson, 1941, <i>Between the planets</i> (Cambridge, MA: Harvard University Press).	
1941, Jan 10	Apollo NEA 2014 AW32 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.37 LD. Minimum miss distance 0.27	

	LD. [1941-01] See: 2014 AW32 - JPL , 2014 AW32 - SSA See also: 10 Jan 2014 .
1941, Apr 9	Chelyabinsk Airburst and Fireball (Russia). See: http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1941, Jul 24	Apollo NEA 2006 BC8 ($H = 25.1$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 5.40 LD. Minimum miss distance 0.99 LD. See: 2006 BC8 – S2P , 2006 BC8 - JPL
1941, Oct 9	Apollo NEA 2011 UK10 ($H = 24.7$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 2.34 LD. Minimum miss distance 0.30 LD. See: 2011 UK10 - JPL , 2011 UK10 - SSA
1941, Oct 30	Aten NEA 2018 UC ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 4.90 LD. Minimum miss distance 0.91 LD. See: 2018 UC - JPL , 2018 UC - SSA See also: 10 Jun 2005 .
1942 , Feb	H.H. Nininger, 1942, <i>Popular Astronomy</i> , 50, 111, "A celestial bomb." On the Forest City (Iowa, USA) fall of 2 May 1890. See: http://adsabs.harvard.edu/abs/1942PA.....50..111N
1942, Mar 22	Aten NEA 2006 GB ($H = 20.2$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 4.35 LD. Minimum miss distance 4.35 LD. See: 2006 GB - JPL , 2006 GB - SSA See also: 22 Mar 2037 , 22 Mar 2081 .
1942, Apr 2	Apollo NEA 2021 GE2 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 3.90 LD. Minimum miss distance 0.96 LD. See: 2021 GE2 – S2P , 2021 GE2 - JPL See also: 3 Apr 2021 , 2 Apr 2030 .
1942, Apr 26	Apollo NEA 69230 Hermes (1937 UB , $H = 17.5$ mag, $D \approx 1100$ m, PHA) passed Earth at a nominal miss distance of 1.65 LD. Minimum miss distance 1.65 LD. See: 1937 UB JPL , 69230 Hermes - SSA See also: http://en.wikipedia.org/wiki/69230_Hermes See also: 29 Oct 1914 , 30 Oct 1937 , 1 Nov 1954 , 31 Oct 2086 , 30 Apr 2123 .
1942, Jun 30	Aten NEA 2020 MK3 ($H = 25.8$ mag, $D \approx 24$ m) passed Earth at a nominal miss distance of 4.98 LD. Minimum miss distance 0.97 LD. See: 2020 MK3 – S2P , 2020 MK3 – JPL

1943	Antoine de Saint Exupéry, 1943, <i>Le Petit Prince</i> (Paris: Editions Gallimard). Featuring fictional asteroid B612. See: http://en.wikipedia.org/wiki/The_Little_Prince See also: http://www.universetoday.com/96509/chasing-the-little-prince-in-new-york-city/
1943, Mar 27	Apollo NEA 2018 EM4 ($H = 25.3$ mag, $D \approx 37$ m) passed Earth at a nominal miss distance of 3.74 LD. Minimum miss distance 0.07 LD. See: 2018 EM4 - JPL , 2018 EM4 - SSA See also: 26 Mar 2063 .
1943, May 13	Apollo NEA 2015 KG158 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 7.13 LD. Minimum miss distance 0.66 LD. See: 2015 KG158 - JPL , 2015 KG158 - SSA
1943, Jun 2	Apollo NEA 437844 (1999 MN) , $H = 20.8$ mag, $D \approx 250$ m, PHA) passed Earth at a nominal miss distance of 4.86 LD. Minimum miss distance 4.86 LD. See: 1999 MN - JPL , 1999 MN - SSA See also: 2 Jun 1938, 4 Jun 2110, 4 Jun 2137, 3 Jun 2148 .
1944 , Jan 30	Apollo NEA 2013 PG10 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 6.78 LD. Minimum miss distance 0.78 LD. See: 2013 PG10 – S2P , 2013 PG10 – JPL
1944, Feb 6	Apollo NEA 2013 VA10 ($H = 22.4$ mag, $D \approx 120$ m) passed Earth at a nominal miss distance of 4.30 LD. Minimum miss distance 4.29 LD. See: 2013 VA10 – SSA , 2013 VA10 – JPL See also: 6 Feb 1944, 8 Feb 2161 .
1944, Mar 9	Apollo NEA 2017 DA36 ($H = 25.1$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 1.27 LD. Minimum miss distance 0.31 LD. See: 2017 DA36- JPL , 2017 DA36- SSA
1944, Jul 8	Aten NEA 2011 OB ($H = 19.7$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 3.44 LD. Minimum miss distance 3.44 LD. See: 2011 OB - JPL , 2011 OB - SSA
1944, Nov 14	Apollo NEA 2007 VF189 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 6.29 LD. Minimum miss distance 0.92 LD. See: 2007 VF189 - JPL , 2007 VF189 - SSA See also: 14 Nov 2007 .

1944, Dec	Daytime Fireball over Bulannyo (Rhodesia). Norman Appleton witnessed a meteor so bright he remembered it his entire life. Right before his eyes a tremendous smoking fireball streaked across the daytime sky. Years later, as an accomplished member of the Guild of Aviation Artists, he recorded his memories in a painting. See: http://apod.nasa.gov/apod/ap010728.html http://www.gava.org.uk/index.cfm?page=searchresults&searchType=quickSearch
1945, Feb 14	Apollo NEA 2016 CM194 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 9.09 LD. Minimum miss distance 0.93 LD. See: 2016 CM194 – S2P , 2016 CM194 – JPL
1945, Mar 15	Aten NEA 2020 FK1 ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 9.24 LD. Minimum miss distance 0.16 LD. See: 2020 FK1 – S2P , 2020 FK1 - JPL See also: 15 Mar 2070.
1945, May 4	Apollo NEA 2012 HA34 ($H = 25.3$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 4.87 LD. Minimum miss distance > 0.02 LD. See: 2012 HA34 – S2P , 2012 HA34 – JPL
1945, Jun 1	Aten NEA 2008 LH2 ($H = 23.6$ mag, $D \approx 70$ m) passed Earth at a nominal miss distance of 3.48 LD. Minimum miss distance 1.00 LD. See: 2008 LH2 - JPL , 2008 LH2 - SSA
1945, Jul 18	Apollo NEA 2016 BA15 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 4.81 LD. Minimum miss distance 0.11 LD. See: 2016 BA15 - JPL , 2016 BA15 - SSA See also: 21 Jul 2056.
1945, Sep 4	Apollo NEA 2014 RC ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 6.56 LD. Minimum miss distance 0.42 LD. See: 2014 RC - JPL , 2014 RC - SSA See also: 7 Sep 2014.
1945, Nov 2	Aten NEA 2016 VA ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 9.60 LD. Minimum miss distance 0.05 LD. See: 2016 VA - JPL , 2016 VA - SSA
1946, Apr 4	Apollo NEA 2020 TX2 ($H = 20.8$ mag, $D \approx 240$ m, PHA) passed Earth at a nominal miss distance of 6.96 LD. Minimum miss distance 0.31 LD. See: 2020 TX2 – S2P , 2020 TX2 – JPL

1946, Aug 7	Asteroid 137108 (1999 AN10, $H = 18.4$ mag, $D \approx 700$ m, PHA) passed Earth at 2.43 LD. Minimum miss distance 2.43 LD. See: 1999 AN10 - JPL , 137108 1999 AN10 - SSA See also: 7 Aug 2027 .
1946, Oct 13	Apollo NEA 2011 UT ($H = 25.9$ mag, $D \approx 24$ m) passed Earth at a nominal miss distance of 3.93 LD. Minimum miss distance 0.69 LD. See: 2011 UT – S2P , 2011 UT– JPL
1946, Nov 15	Apollo NEA 2018 VJ10 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 5.48 LD. Minimum miss distance 0.98 LD. See: 2018 VJ10 - SSA , 2018 VJ10 - JPL See also: 14 Nov 2018 .
1947	IAU Minor Planet Center (MPC) , established by the International Astronomical Union, Commission 20 , and succeeding the work which was carried out since 1910 by the Rechen-Institut in Berlin-Dahlem (Germany), started operations at the Observatory of the University of Cincinnati (Ohio, USA), director Paul Herget (1908 – 1981, USA). At the time, 1564 minor planets were numbered. Upon Herget's retirement in 1978, the amount of numbered minor planets had reached 2060, and the MPC moved to the Harvard-Smithsonian Center for Astrophysics, Cambridge (MA, USA) with Brian G. Marsden (1937 – 2010) as director. For a history of the MPC , see: - C.M. Bardwell, 1989, "A brief history of the Minor Planet Center ." - B.G. Marsden, 2009, <i>IAU Information Bulletin</i> , No. 104, p. 67, "History of the Minor Planet Center." See: http://www.cfa.harvard.edu/iau/mpc.html http://www.iau.org/static/publications/IB104.pdf , p. 67.
1947, Feb 12	Sikhote-Alin Fireball and Airburst passed over Sikhote-Alin mountains (Primorye, Russia), creating a 32 km long smoke trail in the sky at an altitude of 5.6 km. The bright flash and the deafening sound of the fall were observed at 300 km around the point of impact, not far from Luchegorsk and ~ 440 km northeast of Vladivostok. The pre-impact mass of the meteoroid may have been 100,000 kg. The strewn field of this meteorite covered an elliptical area of about 1.3 km. Some fragments made craters, the largest of which was about 26 m across and 6 m deep. Ref: - R.A. Gallant, 1997, <i>Sky & Telescope</i> , 93, no. 2, p.50, " Sikhote-Alin : 50 years later." See: http://adsabs.harvard.edu/abs/1997S%26T....93b..50G See also: http://www.lifeslittlemysteries.com/1535-when-space-attacks-6-craziest-

	meteor-impacts-history.html http://en.wikipedia.org/wiki/List_of_meteor_air_bursts http://en.wikipedia.org/wiki/Sikhote-Alin_meteorite
1947, Mar 1	Apollo NEA 2014 PW59 ($H = 21.0$ mag, $D \approx 230$ m, PHA) passed Earth at a nominal miss distance of 4.27 LD. Minimum miss distance 4.26 LD. See: 2014 PW59 - JPL , 2014 PW59 - SSA See also: 26 Feb 1906 .
1947, Apr 4	Apollo NEA 2008 GM2 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 4.95 LD. Minimum miss distance 0.60 LD. See: 2008 GM2 - JPL , 2008 GM2 - SSA See also: 3 Apr 2008 .
1947, Apr 21	Apollo NEA 2016 EK27 ($H = 22.5$ mag, $D \approx 110$ m) passed Earth at a nominal miss distance of 2.37 LD. Minimum miss distance 0.51 LD. See: 2016 EK27 - JPL , 2016 EK27 - SSA
1948	The international yearbook " Ephemerides of minor planets ", published since 1948 for the International Astronomical Union by the Institute of Applied Astronomy, St Petersburg (Russian Federation), contains information on orbital elements of numbered minor planets and the circumstances of their observations during the best observation periods.
1948, Jan 24	Apollo NEA 2017 BX ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.17 LD. [1948-01] See: 2017 BX – S2P , 2017 BX - JPL
1948, Mar 31	Aten NEA 2015 FA285 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 1.90 LD. Minimum miss distance 0.43 LD. See: 2015 FA285 - JPL , 2015 FA285 - SSA
1948, May 11	Aten NEA 2020 JQ1 ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 6.98 LD. Minimum miss distance 0.27 LD. See: 2020 JQ1 – S2P , 2020 JQ1 – JPL See also: 12 May 1967 , 12 May 2039 .
1949	Ralph E. Baldwin (... – 19.., USA), <i>The Face of the Moon</i> (Chicago: UCP), describing the damage that a NEO impact might cause on Earth. Reviews: http://adsabs.harvard.edu/abs/1949PA.....57..257B
1949, Jan 1	Apollo NEA 2003 YS70 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a

	nominal miss distance of 0.67 LD. Minimum miss distance 0.63 LD. [1949-01] See: 2003 YS70 - JPL , 2003 YS70 - SSA
1949, Apr 14	Aten NEA 99942 Apophis (2004 MN4, $H = 19.7$ mag, $D = 310 \pm 30$ m, orbital $P = 0.89$ yr, PHA) passed Earth at a nominal miss distance of 10.89 LD. Minimum miss distance 10.87 LD. See: 2004 MN4 - JPL , 99942 Apophis - SSA See also: http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis http://en.wikipedia.org/wiki/99942_Apophis See also: 13 Apr 1907, 14 Apr 1998, 13 Apr 2029, 23 Mar 2036, 11 Sep 2102, 12 Apr 2116, 7 Apr 2123.
1949, Jun 11	Kunashak Meteor Shower. A shower of about 20 meteorites fell near Kunashak (Chelyabinsk Province, Russia). Total recovered weight over 200 kg, the largest stones weighing 120 kg, 40 kg, and 36 kg. See: http://books.google.nl/books?id=mkdHJR35Q_8C&pg=PA285&redir_esc=y#v=onepage&q&f=false http://www.lpi.usra.edu/meteor/metbull.php?code=12377 http://en.wikipedia.org/wiki/Chelyabinsk_meteor
1949, Jun 27	Discovery of Earth-orbit crossing Apollo NEA 1566 Icarus (1949 MA, $H = 16.3$ mag, $D = 1300$ m, also Venus- and Mercury-orbit crossing, PHA) by Walter Baade (1893 – 1960, Germany/USA). In 1968 Icarus became the first minor planet to be observed by radar. It is plausible that Icarus and asteroid 5786 Talos (1991 RC, $H = 16.0$ mag, $D \approx 1.3$ km) and asteroid 2007 MK6 ($H = 19.9$ mag, $D \approx 350$ m) are related. See: 1949 MA - JPL , 1566 Icarus - SSA See also: http://en.wikipedia.org/wiki/1566_Icarus Ref: - D.K. Yeomans, 1991, <i>Astronomical Journal</i>, 101, 1920, "A comet among the near-earth asteroids?" See: http://adsabs.harvard.edu/abs/1991AJ....101.1920Y Erratum: http://adsabs.harvard.edu/abs/1992AJ....104.1266Y - D. Steel, 1991, <i>Nature</i>, 354, 265, "Our asteroid-pelted planet." See: http://adsabs.harvard.edu/abs/1991Natur.354..265S - K. Ohtsuka, H. Arakida, T. Ito, et al., 2007, <i>Astrophysical Journal Letters</i>, 668, L71, "Apollo asteroids 1566 Icarus and 2007 MK6: Icarus family members?" See: http://adsabs.harvard.edu/abs/2007ApJ...668L..71O

1949, Aug 10	Apollo NEA 2018 PD20 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 3.49 LD. Minimum miss distance 0.58 LD. See: 2019 PD20 – SSA , 2019 PD20 – JPL
1949, Oct 14	Apollo NEA 2016 TZ55 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 6.77 LD. Minimum miss distance 0.22 LD. See: 2016 TZ55 - JPL , 2016 TZ55 - SSA
1949, Dec 11	Aten NEA 2010 XR69 ($H = 26.1$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 5.03 LD. Minimum miss distance 0.89 LD. See: 2010 XR69 -JPL , 2010 XR69 - SSA
1950 , Jan 1	13 NEAs known, of which 5 PHAs . See: http://neo.jpl.nasa.gov/stats/
1950	The Yerkes-McDonald Survey of Asteroids (1950 – 1952), down to $v = 16.5$, was performed by astronomers Gerard P. Kuiper (1905 – 1973, Netherlands/USA), George A. Van Biesbroeck (1880 – 1974, Belgium/USA), Cornelis J. van Houten (1920 – 2002, Netherlands), Ingrid M. van Houten-Groeneveld (Netherlands) and Tom Gehrels (Netherlands/USA). A number of 3247 objects were found. Ref: - G.P. Kuiper, Y. Fujita, T. Gehrels, I. M. Groeneveld, J. Kent, G.A. Van Biesbroeck, C.J. van Houten, 1958, <i>Astrophysical Journal Supplement</i> , 3, 289, "Survey of asteroids". See: http://adsabs.harvard.edu/abs/1958ApJS....3..289K
1950, Feb 10	Aten NEA 2009 BE58 ($H = 21.8$ mag, $D \approx 150$ m, PHA) passed Earth at a nominal miss distance of 4.08 LD. Minimum miss distance 4.07 LD. See: 2009 BE58 - JPL , 2009 BE58 - SSA See also: 11 Feb 2058 , 13 Feb 2194 .
1950, Sep 10	Apollo NEA 2018 RB1 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 4.17 LD. Minimum miss distance 0.28 LD. See: 2018 RB1 -JPL , 2018 RB1 - SSA
1950, Oct 2	Apollo NEA 2018 TP5 ($H = 25.8$ mag, $D \approx 24$ m) passed Earth at a nominal miss distance of 1.09 LD. Minimum miss distance 0.84 LD. See: 2018 TP5 – S2P , 2018 TP5 – JPL
1950, Dec 12	Apollo NEA 523685 (2014 DN112) , ($H = 19.9$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 4.68 LD. Minimum miss distance 4.67 LD. See: 2014 DN112 - JPL , 2014 DN112 - SSA

1950, Dec 16	Apollo NEA 2017 YJ1 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 7.17 LD. Minimum miss distance 0.18 LD. See: 2017 YJ1 – S2P , 2017 YJ1 – JPL
1951	Ernst Julius Öpik (1893-1985, Estonia – Ireland), 1951, <i>Proc. Royal Irish Academy</i> , 54A, 165, "Collision probabilities with the planets and the distribution of interplanetary matter." Discussing the possible importance of the Yarkovsky effect, discovered by Ivan Osipovich Yarkovsky (1844-1902, Russian-Polish civil engineer) for meteoroids moving about the Solar System. See: http://adsabs.harvard.edu/abs/1951PRIA...54..165O http://en.wikipedia.org/wiki/Yarkovsky_effect
1951, Apr 30	Asteroid 2013 JL22 ($H = 21.3$ mag, $D \approx 190$ m, PHA) passed Earth at a nominal miss distance of 3.64 LD. Minimum miss distance 3.64 LD. See: 2013 JL22 - JPL , 2013 JL22 - SSA
1951, May 2	Aten NEA 2019 JX1 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 2.20 LD. Minimum miss distance 0.75 LD. See: 2019 JX1 - SSA , 2019 JX1 - JPL See also: 2 May 2019
1951, Jun 22	Apollo NEA 496860 (1999 XL136 , $H = 19.4$ mag, $D \approx 500$ m, PHA) passed Earth at a nominal miss distance of 3.05 LD. Minimum miss distance 3.05 LD. See: 1999 XL136 - JPL , 1999 XL136 - SSA See also: 23 Jun 2012 .
1952	V.V. Radzievskii, 1952, <i>Astron. Zh.</i> , 29, 162, "A mechanism for the disintegration of asteroids and meteorites". See: http://adsabs.harvard.edu/abs/1952AZh....29..162R
1952, Jun 7	Aten NEA 2014 HQ124 ($H = 19.0$ mag, $D \approx 370$ m, PHA) passed Earth at a nominal miss distance of 3.35 LD. Minimum miss distance 3.35 LD. See: 2014 HQ124 - JPL , 2014 HQ124 - SSA See also: https://en.wikipedia.org/wiki/2014_HQ124 See also: 7 Jun 1901 , 8 Jun 2014 , 8 Jun 2065 .
1952, Oct 23	Apollo NEA 2009 UU1 ($H = 24.8$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 0.68 LD. Minimum miss distance 0.68 LD. [1952-01] See: 2009 UU1 – S2P , 2009 UU1 – JPL

1952, Dec	E.J. Öpik, 1952, <i>Irish Astronomical Journal</i> , 2, 95, "Collisions with heavenly bodies." See: http://adsabs.harvard.edu/abs/1952IrAJ....2...95O
1952, Dec 9	Apollo NEA 2014 QK434 ($H = 19.5$ mag, $D \approx 500$ m, PHA) passed Earth at a nominal miss distance of 4.08 LD. Minimum miss distance 3.95 LD. See: 2014 QK434 - JPL , 2014 QK434 - SSA
1952, Dec 24	Asteroid 450293 (2004 LV3 , $H = 19.1$ mag, $D \approx 500$ m, PHA) passed Earth at 4.61 LD. Minimum miss distance 4.61 LD. See: 2004 LV3 - JPL , 2004 LV3 - SSA See also: 25 Dec 2049 .
1953 , Apr 5	Apollo NEA 2020 GC1 ($H = 25.2$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 2.86 LD. Minimum miss distance 0.65 LD. See: 2020 GC1 – S2P , 2020 GC1 – JPL
1953, May 2	Apollo NEA 2016 JA6 ($H = 26.4$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 1.07 LD. Minimum miss distance 0.89 LD. See: 2016 JA6 – S2P , 2016 JA6 – JPL
1953, Nov 29	Aten NEA 153201 (2000 WO107 , $H = 19.4$ mag, $D \approx 510$ m, PHA) passed Earth at 2.52 LD. Minimum miss distance 2.52 LD. See: 2000 WO107 - JPL , 2000 WO107 - SSA See also: https://en.wikipedia.org/wiki/(153201)_2000_WO107 See also: 30 Nov 2093 , 1 Dec 2140 .
1954	A.C.B. Lovell, 1954, <i>Meteor Astronomy</i> (Oxford: Clarendon Press). See: http://adsabs.harvard.edu/abs/1954QB741.L6..... A critical review of this book, with comments on meteor velocities in particular, is given by E.J. Öpik, 1955, <i>Irish Astronomical Journal</i> , 3, 144, "Meteor astronomy." See: http://adsabs.harvard.edu/abs/1955IrAJ....3..144O
1954, Jan 18	Apollo NEA 2017 BG92 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 5.77 LD. Minimum miss distance 0.52 LD. See: 2017 BG92 – S2P , 2017 BG92 – JPL
1954, Feb 28	Apollo NEA 462550 (2009 CB3 , $H = 19.7$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 3.47 LD. Minimum miss distance 3.47 LD. See: 2009 CB3 - JPL , 2009 CB3 - SSA
1954, Mar 13	Apollo NEA 2013 RZ53 ($H = 31.4$ mag, $D \approx 1.9$ m) passed Earth at a

	nominal miss distance of 0.27 LD. Minimum miss distance 0.27 LD. [1954-01] See: 2013 RZ53 - JPL , 2013 RZ53 - SSA See also: 18 Sep 2013 .
1954, Mar 18	Aten NEA 2005 FN ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 5.96 LD. Minimum miss distance 0.06 LD. See: 2005 FN - JPL , 2005 FN - SSA
1954, Aug 1	Apollo NEA 2011 CC22 ($H = 21.3$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 11.87 LD. Minimum miss distance 11.86 LD. See: 2011 CC22 - SSA , 2011 CC22 - JPL See also: 4 Aug 2017 .
1954, Aug 1	Apollo NEA 2019 BV2 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 1.30 LD. Minimum miss distance 0.37 LD. See: 2019 BV2 - JPL , 2019 BV2 - SSA See also: 26 Jan 2016 , 2 Aug 2064 .
1954, Nov 30	Hodges meteorite . First known modern case of a human hit by a space rock occurred in Sylacauga (Alabama, USA). A 4 kg stone chondrite crashed through a roof and hit Mrs. Ann Hodges in her living room after it bounced off her radio. She was badly bruised. The Hodges meteorite , or Sylacauga meteorite , is on exhibit at the Alabama Museum of Natural History. See: http://www.lifesslittlemysteries.com/1535-when-space-attacks-6-craziest-meteor-impacts-history.html http://www.smithsonianmag.com/smart-news/only-person-ever-hit-meteorite-real-trouble-began-later-180961238/ http://en.wikipedia.org/wiki/Sylacauga_(meteorite)
1954, Dec	G.P. Kuiper, 1954, <i>Proceedings of the National Academy of Sciences of the United States of America</i> , 40(12), 1096, "On the origin of the lunar surface features." See: http://adsabs.harvard.edu/abs/1954PNAS...40.1096K
1954, Dec 4	Apollo NEA 2012 KT42 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 2.86 LD. Minimum miss distance 0.03 LD. See: 2012 KT42 - JPL , 2012 KT42 - SSA See also: https://en.wikipedia.org/wiki/2012_KT42 See also: 3 Dec 1915 , 29 May 2012 .
1955 , Feb 22	Aten NEA 2021 DA2 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 1.25 LD. Minimum miss distance 0.90 LD.

	See: 2021 DA2 – S2P , 2021 DA2 – JPL See also: 21 Feb 2021 , 21 Feb 2050 .
1955, Mar 13	Apollo NEA 2020 EQ ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 1.36 LD. Minimum miss distance 0.15 LD. See: 2020 EQ – S2P , 2020 EQ – JPL
1955, Apr 18	Apollo NEA 2021 HY2 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 7.62 LD. Minimum miss distance 0.32 LD. See: 2021 HY2 – S2P , 2021 HY2 – JPL
1955, Jun 19	Apollo NEA 2015 LR21 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.55 LD. [1955-01] See: 2015 LR21 - JPL , 2015 LR21 - SSA
1955, Sep 14	Apollo NEA 2006 SC ($H = 25.2$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 9.42 LD. Minimum miss distance 0.71 LD. See: 2006 SC – S2P , 2006 SC – JPL
1955, Sep 17	Aten NEA 2015 KE ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.61 LD. Minimum miss distance 0.012 LD (= 0.72 R_{Earth} from the geocenter). [1955-02] See: 2015 KE - JPL , 2015 KE - SSA See also: 7 May 2107 .
1956, Jan	M.W. De Laubenfels, 1956, suggested that the dinosaurs demise is due to an impact event and the resulting super-hot winds that would result. He scaled up the effects of the Tunguska blast and made first suggestion of the death of the dinosaurs being impact related. Mammals first appeared in Cretaceous with the most outstanding type differing little from the modern opossum. The author argues for a brief period of extreme heat enough to kill exposed large animals. Birds, mammals, aquatic animals would have survived. He notes in October 1937 the close Earth approach of Hermes and the Tunguska event . He computes an amount of heat available from a 100 m sized impactor at 10 km/s and notes that if kinetic energy turned into heat, it would be enough to boil 10^{16} tons of water whereas entire oceans are 10^{18} tons. - Ref: M.W. De Laubenfels (Oregon State College), 1956, <i>Journal of Paleontology</i> , 30, 207, "Dinosaur extinction: one more hypothesis." See: http://www.norwebster.com/astrohit/
1956, May	C.S. Beals, G.M. Ferguson, A. Landau, 1956, <i>Sky & Telescope</i> , 15, 296, "The Holleford Crater in Ontario." See: http://adsabs.harvard.edu/abs/1956S%26T....15..296B

1956, Oct 13	Apollo NEA 496817 (1989 VB , $H = 20.1$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 7.26 LD. Minimum miss distance 7.26 LD. See: 1989 VB - SSA , 1989 VB - JPL See also: 29 Sep 2017 , 20 Oct 2078 .
1956, Nov	Harold C. Urey (1893 – 1981, USA), 1956, <i>Astrophysical Journal</i> , 124, 623, "Diamonds, meteorites, and the origin of the Solar System." See: http://adsabs.harvard.edu/abs/1956ApJ...124..623U
1956, Nov 24	Apollo NEA 2013 NJ ($H = 22.1$ mag, $D \approx 130$ m) passed Earth at a nominal miss distance of 2.64 LD. Minimum miss distance 2.60 LD. See: 2013 NJ - SSA , 2013 NJ - JPL See also: 24 Nov 1997 , 26 Nov 2013 , 26 Nov 2067 .
1956, Dec 16	Aten NEA 33342 (1998 WT24 , $H = 18.3$ mag, $D \approx 415$ m, PHA) passed Earth at a nominal miss distance of 3.52 LD. Minimum miss distance 3.52 LD. See: 1998 WT24 - JPL , 1998 WT24 - SSA See also: http://neo.jpl.nasa.gov/images/1998wt24.html http://science.nasa.gov/science-news/science-at-nasa/2001/ast14dec_1/ http://www.jpl.nasa.gov/news/news.php?feature=4800 https://en.wikipedia.org/wiki/(33342)_1998_WT24 See also: 16 Dec 1908 , 16 Dec 2001 , 11 Dec 2015 , 18 Dec 2099
1957 , Jan 31	Apollo NEA 2019 CD2 ($H = 19.9$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 3.03 LD. Minimum miss distance 0.13 LD. See: 2019 CD2 - JPL , 2019 CD2 - SSA
1957, Sep	C.S. Beals, 1957, <i>Sky & Telescope</i> , 16, 526, "A probable meteorite crater of great age." See: http://adsabs.harvard.edu/abs/1957S%26T....16..526B
1957, Sep 24	Apollo NEA 2006 SR131 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 2.82 LD. Minimum miss distance 0.39 LD. See: 2006 SR131- S2P , 2006 SR131 - JPL
1957, Oct 10	Aten NEA 2020 TK5 ($H = 23.7$ mag, $D \approx 70$ m) passed Earth at a nominal miss distance of 0.86 LD. Minimum miss distance 0.78 LD. [1957-01] See: 2020 TK5 S2P , 2020 TK5 - JPL
1957, Oct 23	Aten NEA 2020 UO4 ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a

	nominal miss distance of 2.31 LD. Minimum miss distance 0.79 LD. See: 2020 UO4 – S2P , 2020 UO4 – JPL See also: 19 Oct 2068 .
1957, Oct 26	Apollo NEA 2019 UY7 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 2.01 LD. Minimum miss distance 0.05 LD. See: 2019 UY7 – SSA , 2019 UY – JPL
1957, Dec 10	Apollo NEA 2010 XW58 ($H = 25.0$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 0.16 LD. Minimum miss distance 0.16 LD. [1957-02] See: 2010 XW58 - JPL , 2010 XW58 - SSA
1958	E.J. Öpik, 1958, <i>Physics of meteor flight in the atmosphere</i> (New York: Interscience Publishers). See: http://adsabs.harvard.edu/abs/1958QB741.O38.....
1958, Feb 22	C.S. Beals, 1958, <i>Nature</i> , 181, 559, "A survey of terrestrial craters." See: http://adsabs.harvard.edu/abs/1958Natur.181..559B
1958, Mar	E.J. Öpik, 1958, <i>Irish Astronomical Journal</i> , 5, 34, "On the catastrophic effect of collisions with celestial bodies." Öpik proposed that NEO impacts might have handicapped the development of land in the paleontological history. See: http://adsabs.harvard.edu/abs/1958QB741.O38.....
1958, Mar 9	Apollo NEA 2018 SP1 ($H = 23.1$ mag, $D \approx 90$ m) passed Earth at a nominal miss distance of 8.76 LD. Minimum miss distance 0.35 LD. See: 2018 SP1 – S2P , 2018 SP1– JPL
1958, Jul	G.P. Kuiper, Y. Fujita, T. Gehrels, I.M. Groeneveld, J. Kent, G.A. Van Biesbroeck, C.J. van Houten, 1958, <i>Astrophysical Journal Supplement</i> , 3, 289, "Survey of asteroids". See: http://adsabs.harvard.edu/abs/1958ApJS....3..289K
1958, Oct 11	Aten NEA 2008 TZ ($H = 25.2$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 4.17 LD. Minimum miss distance 1.002 LD. See: 2008 TZ - JPL , 2008 TZ - SSA
1958, Oct 29	Apollo NEA 2020 TD8 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 2.11 LD. Minimum miss distance 0.62 LD. See: 2020 TD8 – S2P , 2020 TD8 – JPL
1958, Dec 21	Aten NEA 2020 XY4 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 4.48 LD. Minimum miss distance 0.59 LD.

	See: 2020 XY4 – S2P , 2020 XY4 – JPL See also: 20 Dec 1924 .
1959 , Jan 5	Apollo NEA 2020 JV ($H = 21.6$ mag, $D \approx 170$ m, PHA) passed Earth at a nominal miss distance of 5.90 LD. Minimum miss distance 1.77 LD. See: 2020 JV – S2P , 2020 JV – JPL
1959, Jan 23	Apollo NEA 2021 OV ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 8.34 LD. Minimum miss distance 0.84 LD. See: 2021 OV – S2P , 2021 OV – JPL See also: 20 Jul 2021 .
1959, Jan 27	Aten NEA 2012 BX34 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.53 LD. Minimum miss distance 0.40 LD. [1959-01] See: 2012 BX34 - JPL , 2012 BX34 - SSA See also: https://en.wikipedia.org/wiki/2012_BX34 See also: 27 Jan 2012
1959, Apr 7	Příbram Meteorite Fall , the first meteorite simultaneously observed by several stations in the Czech Republic. The network was initiated locally at Ondřejov Observatory. By 1963, the network consisted of 5 stations. In 1968 it had expanded by the installation of about 15 new stations in Germany, and was named the European Fireball Network . - Ref: P. Spurný, J. Borovička, L. Shrbený, 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symposium No. 236 on <i>Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i> , Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 121, "Automation of the Czech part of the European Fireball Network : equipment, methods and first results." See: http://adsabs.harvard.edu/abs/2007IAUS..236..121S http://www.dlr.de/pf/en/desktopdefault.aspx/tabid-623/1043_read-26813/ http://en.wikipedia.org/wiki/European_Fireball_Network
1959, May 28	Aten NEA 2021 LL15 ($H = 26.4$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 8.64 LD. Minimum miss distance 0.11 LD. See: 2021 LL15 – S2P , 2021 LL15 – JPL
1959, May 29	Apollo NEA 2020 DY1 ($H = 21.9$ mag, $D \approx 150$ m, PHA) passed Earth at a nominal miss distance of 5.22 LD. Minimum miss distance 4.79 LD. See: 2020 DY1 – S2P , 2020 DY1 - JPL

1959, Jul 12	Amor NEA 2017 NM6 ($H = 19.0$ mag, $D \approx 600$ m, PHA) passed Earth at a nominal miss distance of 1.89 LD. Minimum miss distance 1.85 LD. See: 2017 NM6 - JPL , 2017 NM6 - SSA
1959, Aug 20	Apollo NEA 2020 QR5 ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 8.84 LD. Minimum miss distance 0.80 LD. See: 2020 QR5 – S2P , 2020 QR5 – JPL Discovery station: Pan-STARS 1, Haleakala See also: 23 Aug 2020, 24 Aug 2105.
1959, Nov 11	Apollo NEA 2018 VX1 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.87 LD. [1959-02] See: 2018 VX1 - SSA , 2018 VX1 - JPL See also: 10 Nov 2018.
1959, Nov 25	Apollo NEA 2018 WE1 ($H = 26.2$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 8.29 LD. Minimum miss distance 0.77 LD. See: 2018 WE1 - JPL , 2018 WE1 - SSA See also: 25 Nov 2018.
1959, Dec 15	Aten NEA 487577 (2014 YQ15) , ($H = 20.9$ mag, $D \approx 240$ m, PHA) passed Earth at a nominal miss distance of 3.64 LD. Minimum miss distance 3.57 LD. See: 2014 YQ15 - JPL , 2014 YQ15- SSA See also: 15 Dec 2066, 16 Dec 2122.
1960, Jan 1	20 NEAs known, of which 8 PHA6. See: http://neo.jpl.nasa.gov/stats/
1960, Jan 17	Aten NEA 2001 BA16 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 2.14 LD. Minimum miss distance 0.21 LD. See: 2001 BA16 - JPL , 2001 BA16 - SSA See also: 15 Jan 2001.
1960, Feb 25	Apollo NEA 2017 DG16 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 1.96 LD. Minimum miss distance 0.48 LD. See: 2006 SR131– S2P , 2006 SR131 – JPL
1960, Sep - Oct	Tom Gehrels took Palomar Schmidt (1.2-m) plates, on which C.J. van Houten et al. (1970) discovered over 2000 asteroids with $v < 20$ mag, including four NEAs. Ref: C.J. van Houten, I. van Houten-Groeneveld, P. Herget & T. Gehrels, 1970, <i>Astronomy & Astrophysics Suppl.</i> , 2, 339, "The Palomar-Leiden survey of faint minor planets. "

	See: http://adsabs.harvard.edu/abs/1970A%26AS....2..339V C.J. van Houten, P. Herget, B.G. Marsden, 1984, <i>Icarus</i>, 59, 1, "The Palomar-Leiden survey of faint minor planets – Conclusion." See: http://adsabs.harvard.edu/abs/1984Icar...59....1V
1960, Sep 7	Apollo NEA 2021 RS2 ($H = 30.4$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 1.76 LD. Minimum miss distance 0.83 LD. See: 2021 RS2 – S2P , 2021 RS2 - JPL See also: 8 Sep 2021.
1960, Oct 24	Aten NEA 2004 UH1 ($H = 28.2$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.48 LD. Minimum miss distance 0.41 LD. [1960-01] See: 2004 UH1 - JPL , 2004 UH1 - SSA See also: 24 Oct 2004.
1960, Nov 22	Apollo NEA 2019 WG2 ($H = 25.0$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 3.50 LD. Minimum miss distance 0.72 LD. See: 2019 WG2 – SSA , 2019 WG2 – JPL
1961 , Mar 24	Aten NEA 234145 (2000 EW70), $H = 21.9$ mag, $D \approx 344$ m, PHA) passed Earth at a nominal miss distance of 3.75 LD. Minimum miss distance 3.75 LD. See: 2000 EW70 - JPL , 2000 EW70 - SSA See also: 24 Mar 1971.
1961, Apr 12	Aten NEA 163243 (2002 FB3), $H = 16.6$ mag, $D \approx 1620$ m, PHA) passed Earth at a nominal miss distance of 4.90 LD. Minimum miss distance 4.90 LD. See: 2002 FB3 - JPL , 2002 FB3 - SSA See also: https://en.wikipedia.org/wiki/(163243)_2002_FB3
1961, Sep 14	Aten NEA 2020 RF3 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 8.56 LD. Minimum miss distance 0.77 LD. See: 2020 RF3 – S2P , 2020 RF3 - JPL See also: 14 Sep 2020, 15 Sep 2020.
1961, Oct	Eugene M. Shoemaker and Edward C.T. Chao proved that Nördlingen Ries crater ($d = 24$ km, Nördlingen, western Bavaria, Germany), formed ~ 14.4 My ago in the Miocene, was caused by meteorite impact. Another impact crater, the much smaller (3.8 km diameter) Steinheim crater, is located ~ 42 km WSW from the centre of Ries. The two craters are believed to have formed nearly simultaneously by the impact of a binary asteroid. The impactors probably had diameters of ~ 1.5 km (Ries) and 150 m (Steinheim),

	and a pre-impact separation of some tens of kilometers. Ref: - E.M. Shoemaker, E.C.T. Chao, 1961, <i>Journal of Geophysical Research</i>, 66, 3371, "New evidence for the impact origin of the Ries Basin, Bavaria, Germany." See: http://adsabs.harvard.edu/abs/1961JGR...66.3371S See also: http://en.wikipedia.org/wiki/N%C3%B6rdlinger_Ries http://www.unb.ca/passc/ImpactDatabase/images/ries.htm http://www.lpi.usra.edu/meetings/nordlingen2010/ http://www.hq.nasa.gov/alsj/a14/a14ries.html The Earth Impact Database lists some 170 known impact craters on Earth. See: http://www.unb.ca/passc/ImpactDatabase/
1961, Oct 11	Apollo NEA 2008 TC3 ($H = 30.3$ mag, $D \approx 4.1$ m, Apollo NEO) passed Earth at a nominal miss distance of 7.25 LD. Minimum miss distance 3.20 LD. See: 2008 TC3 - JPL , 2008 TC3 - SSA See also: 4 Oct 1917, 2 Oct 1971, 27 Jan 1988, 6 Oct 2008.
1962, Mar 16	Aten NEA 2021 FA ($H = 25.1$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 6.03 LD. Minimum miss distance 0.90 LD. See: 2021 FA S2P , 2021 FA - JPL
1962, Mar 24	H.C. Urey, 1962, <i>Nature</i>, 193, 1119, " Life-forms in meteorites: origin of life-like forms in carbonaceous chondrites. Introduction." See: http://adsabs.harvard.edu/abs/1962Natur.193.1119U
1962, Mar 30	Aten NEA 2002 GQ ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 3.69 LD. Minimum miss distance 0.51 LD. See: 2002 GQ - JPL , 2002 GQ - SSA See also: 20 Mar 2035.
1963	Eugene M. Shoemaker (1928 – 1997, USA) and colleagues firmly established the impact origin of the Meteor Crater in Arizona. Meteor Crater is located approximately 69 km east of Flagstaff, near Winslow in the northern Arizona desert of the United States. The site was formerly known as the Canyon Diablo Crater. Scientists generally refer to it as Barringer Crater, in honor of the geologist Daniel Barringer (1860 – 1929) who was first to suggest that it was produced by meteorite impact. Barringer Meteor Crater lies at an elevation of about 1,740 m above sea level. It is ~ 1,200 m in diameter, 170 m deep, and is surrounded by a rim that rises 45 m above the surrounding plains. The center of the crater is filled with 210 – 240 m of rubble lying above crater bedrock. The incoming asteroid had a diameter of ~ 25 m and a velocity of 15 km/s. The

	largest meteorite found is the so-called Holsinger meteorite, weighing 639 kg, on display in the Meteor Crater Visitor Center on the rim of the crater. See: http://en.wikipedia.org/wiki/Meteor_Crater http://en.wikipedia.org/wiki/Barringer_Crater http://en.wikipedia.org/wiki/Holsinger_Meteorite Ref: - E.M. Shoemaker, 1963, in: B.M. Middlehurst & G.P. Kuiper (eds.), <i>The Moon, Meteorites, and Comets</i> (Chicago: UCP), p. 301, "Impact mechanics at Meteor Crater, Arizona." See: http://adsabs.harvard.edu/abs/1963mmc..book..301S - D.J. Roddy, E.M. Shoemaker, 1995, <i>Meteoritics</i> 30(5), 567, "Meteor Crater (Barringer Meteorite Crater), Arizona: summary of impact conditions." See: http://adsabs.harvard.edu/abs/1995Metic..30Q.567R - M. Boslough, 1996, <i>Skeptical Inquirer</i>, Vol. 20.2, March/April 1996, "Scientific knowledge is money in the bank." See: http://www.csicop.org/si/show/scientific_knowledge_is_money_in_the_bank - D.A. Kring, 1997, <i>Meteoritics & Planetary Science</i>, 32, 517, "Air blast produced by the Meteor Crater impact event and a reconstruction of the affected environment." See: http://adsabs.harvard.edu/abs/1997M%26PS...32..517K - D.A. Kring, 1999, <i>Sky & Telescope</i>, 98(5), 48, "Calamity at Meteor Crater." See: http://adsabs.harvard.edu/abs/1999S%26T....98e..48K - H.J. Melosh, G.S. Collins, 2005, <i>Nature</i>, 434, 157, "Meteor Crater formed by a low-velocity impact." See: http://adsabs.harvard.edu/abs/2005Natur.434..157M See also: http://www.unb.ca/passc/ImpactDatabase/images/barringer.htm http://antwarp.gsfc.nasa.gov/apod/ap070623.html
1963	Initiation of the European Fireball Network. Ref: J. Olberst, S. Molau, D. Heinlein, et al., 1998, <i>Meteoritics & Planetary Science</i>, 33, 49, "The 'European Fireball Network': Current status and future prospects". See: http://adsabs.harvard.edu/abs/1998M&PS...33...49O See also: http://www.molau.de/meteore/imc97-2.html http://adsabs.harvard.edu/abs/2007IAUS..236..121S http://www.nature.com/nature/journal/v423/n6936/full/423123a.html http://www.dlr.de/pf/en/desktopdefault.aspx/tabid-623/1043_read-1425/
1963	M.R. Dence, M.J.S. Innes, C.S. Beals, 1963, <i>Astronomical Journal</i>, 68, 534, "On the probable meteorite origin of the Clearwater Lakes, Quebec."

	See: http://adsabs.harvard.edu/abs/1963AJ.....68..534D
1963, Mar	Initiation of the Prairie Meteorite Network , with a prototype station in Havana (IL, USA). By May 1964, 16 stations were operational. Ref: - R.E. McCrosky, H. Boeschstein, 1965, <i>SAO Special Report</i> , No. 173, "The Prairie Meteorite Network ." See: http://adsabs.harvard.edu/abs/1965SAOSR.173.....M - Z. Ceplecha, R.E. McCrosky, 1997, <i>Meteoritics & Planetary Science</i> , 32, A157, " Prairie Network fireballs : data on height, distance and brightness for each measured time-mark." See: http://adsabs.harvard.edu/abs/1997M%26PSA..32..157C
1963, Aug 3	Prince Edward Islands Fireball and Airburst (South Africa). See: http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1963, Nov 2	R.L.C. Gallant, 1963, <i>Nature</i> , 200, 414, "Changes in the Earth's axis due to large meteorite collisions." See: http://adsabs.harvard.edu/abs/1963Natur.200..414G
1963, Nov 4	Apollo NEA 2010 JL88 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 8.33 LD. Minimum miss distance 0.56 LD. See: 2010 JL88 - JPL , 2010 JL88 - SSA See also: https://en.wikipedia.org/wiki/2010_JL88
1963, Nov 11	Apollo NEA 2018 VO3 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 9.64 LD. Minimum miss distance 0.37 LD. See: 2018 VO3 – S2P , 2018 VO3 – JPL
1963, Nov 22	Aten NEA 2010 WC ($H = 25.3$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 3.13 LD. Minimum miss distance 0.99 LD. See: 2010 WC – S2P , 2010 WC – JPL
1964	C.S. Beals, M.R. Dence, A.J. Cohen, 1964, <i>Astronomical Journal</i> , 69, 134, "Evidence suggesting a meteorite impact origin for Lac Couture, Quebec." See: http://adsabs.harvard.edu/abs/1964AJ.....69R.134B
1964	Dandridge M. Cole, Donald W. Cox, 1964, <i>Islands in space: the challenge of the planetoids</i> (Philadelphia: Chilton). See: http://discoveryenterprise.blogspot.com/2007/08/islands-in-space-challenge-of.html
1964	René L.C. Gallant (1906 – 1985, Belgium), 1964, <i>Bombarded Earth</i> (London: John Baker Publishers Ltd). See: http://www.catastrophism.com/cdrom/pubs/books/gallant/index.htm

	http://www.velikovsky.info/Ren%C3%A9_Gallant#cite_note-palmer2003-0
1964, Oct 24	Apollo NEA 2020 FM6 ($H = 21.9$ mag, $D \approx 150$ m, PHA) passed Earth at a nominal miss distance of 2.53 LD. Minimum miss distance 1.55 LD. See: 2020 FM6 – S2P , 2020 FM6 - JPL See also: 25 Oct 2101 .
1965 , Jan 17	Apollo NEA 2007 BD ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 1.002 LD. Minimum miss distance 0.855 LD. See: 2007 BD - JPL , 2007 BD - SSA See also: 18 Jan 2007 .
1965, Mar 31	Revelstoke Fireball and Airburst , 64 km NW of the city of Revelstoke (BC, Canada): an extremely bright bolide giving off sparks was observed to travel for 100 km in 8 seconds. See: http://www.lpi.usra.edu/meteor/metbull.php?code=22592 http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1965, Jun 6	Aten NEA 163348 (2002 NN4) , $H = 20.3$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 3.01 LD. Minimum miss distance 3.01 LD. See: 2002 NN4 - JPL , 2002 NN4 - SSA See also: 5 Jun 1924 , 6 Jun 2070 , 7 Jun 2130 .
1965, Jun 9	Apollo NEA 2021 LC3 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 2.51 LD. Minimum miss distance 0.53 LD. See: 2021 LC3 – S2P , 2021 LC3 - JPL
1965, Jun 29	Aten NEA 2021 NM ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 7.78 LD. Minimum miss distance 0.61 LD. See: 2021 NM – S2P , 2021 NM – JPL See also: 29 Jun 1976 .
1965, Oct 21	Apollo NEA 171576 (1999 VP11) , $H = 18.7$ mag, $D \approx 700$ m, PHA) passed Earth at a nominal miss distance of 4.42 LD. Minimum miss distance 4.36 LD. See: 1999 VP11 - JPL , 1999 VP11 - SSA See also: 21 Oct 1982 , 22 Oct 2086 .
1965, Oct 27	Aten NEA 2005 VL1 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.75 LD. [1965-01] See: 2005 VL1 - JPL , 2005 VL1 - SSA

	See also: 3 Nov 2087 .
1966 , Jan 12	Apollo NEA 2016 AN165 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 3.41 LD. Minimum miss distance 0.31 LD. See: 2016 AN165- JPL , 2016 AN165- SSA See also: 13 Jan 2016 .
1966, Feb 18	Apollo NEA 2011 DS ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 9.47 LD. Minimum miss distance 0.54 LD. See: 2011 DS - JPL , 2011 DS - SSA See also: 14 Aug 1901 , 18 Feb 2050 .
1966, July	In an UPI report, Australian scientist S.T. Butler noted an upcoming close Earth approach by the asteroid 1566 Icarus (1949 MA , $H = 16.0$ mag, $D = 1.3$ km, PHA) in 1968. He suggested that the asteroid could possibly be destroyed by a nuclear warhead if it neared the Earth. Paul Sandorff (MIT, U.S.A.) then assigned a hypothetical problem to his system engineering class. This " Icarus Project " drew a good deal of attention, including a <i>Time Magazine</i> story in June 1967 and a book the following year. See: 1949 MA -JPL , 1566 Icarus - SSA , http://en.wikipedia.org/wiki/Project_Icarus Ref: - <i>Time Magazine</i> , 16 June 1967, "Systems engineering: avoiding an asteroid"; - Louis A. Kleinman (ed.), 1968, " Project Icarus : an MIT student project in systems engineering" (Cambridge: MIT Press); - MIT Students, 1979, " Project Icarus – revised edition" (Cambridge: MIT Press).
1966, Sep 17	Lake Huron, Michigan-Ontario Fireball and Airburst (USA, Canada). See: http://adsabs.harvard.edu/full/1966JRASC..60..257H http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1966, Nov 17	Leonid Fireball over Table Mountain Observatory (Angeles National Forest, Wrightwood, CA, USA). See: http://apod.nasa.gov/apod/ap981113.html
1967 , Feb 5	Vilna Fireball and Airburst (Alberta, Canada). See: http://adsabs.harvard.edu/full/1969JRASC..63...61F http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1967, Mar 29	Aten NEA 2019 FB2 ($H = 26.5$ mag, $D \approx 21$ m), passed Earth at a nominal miss distance of 1.53 LD. Minimum miss distance 0.08 LD.

	See: 2019 FB2 - JPL , 2019 FB2 - SSA
1967, May 12	Aten NEA 2020 JQ1 ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 7.30 LD. Minimum miss distance 0.10 LD. See: 2020 JQ1 – S2P , 2020 JQ1 – JPL See also: 11 May 1948 , 12 May 2039 .
1967, Jun	The largest know meteorite, the Hoba meteorite , lies on the farm "Hoba West", not far from Grootfontein, in the Otjozondjupa Region of Namibia. It has been uncovered in 1920, but, because of its large mass, has never been moved from where it fell. The main mass is estimated at 54,000 kg, and it is the largest known meteorite (as a single piece) and the most massive naturally-occurring piece of iron known at the Earth's surface. The Hoba meteorite is thought to have landed less than 80,000 years ago. It is inferred that the Earth's atmosphere slowed the object down to the point that it fell to the surface at terminal velocity, thereby remaining intact and causing little excavation. The Hoba meteorite is unusual in that it is flat on both major surfaces, possibly causing it to have skipped across the top of the atmosphere in the way a flat stone skips on water. Size: $2.7 \times 2.7 \times 0.9$ m. Ref: - J.D. Fernie, 1967, <i>Journal of the Royal Astronomical Society of Canada</i> , 61, 127, "Journey via Otjiwarongo. A trip to the Hoba Meteorite ." See: http://adsabs.harvard.edu/abs/1967JRASC..61..127F http://en.wikipedia.org/wiki/Hoba_meteorite
1967, Sep 29	Apollo NEA 440212 (2004 OB , $H = 18.9$ mag, $D \approx 600$ m, PHA), passed Earth at a nominal miss distance of 4.35 LD. Minimum miss distance 4.35 LD. See: 2004 OB - JPL , 2004 OB - SSA
1967, Nov 3	Apollo NEA 2014 AA ($H = 30.9$ mag, $D \approx 2.3$ m), passed Earth at a nominal miss distance of 99.33 LD. Minimum miss distance 89.08 LD. Impact on 2 January 2014 . See: 2014 AA - SSA , 2014 AA - JPL See also: http://www.minorplanetcenter.net/mpec/K14/K14A02.html http://www.jpl.nasa.gov/news/news.php?release=2014-001 https://en.wikipedia.org/wiki/2014_AA See also: 26 May 1994 , 21 Mar 1996 , 2 Jan 2014 .
1968	European Fireball Network established. Ref: - P. Spurný, J. Borovička, L. Shrbený, 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symposium No. 236

	on <i>Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i>, Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 121, "Automation of the Czech part of the European Fireball Network: equipment, methods and first results." See: http://adsabs.harvard.edu/abs/2007IAUS..236..121S See also: http://www.dlr.de/pf/en/desktopdefault.aspx/tabid-623/1043_read-26813/ http://en.wikipedia.org/wiki/European_Fireball_Network
1968	C.S. Beals, 1968, <i>Contributions Dominion Observatory Ottawa</i>, 4(29), 1, "Theories of the origin of Hudson Bay. I. On the possibility of a catastrophic origin for the great arc of eastern Hudson Bay." See: http://adsabs.harvard.edu/abs/1968CoDAO...4....1B
1968, Jan	G.W. Wetherill, J.G. Williams, 1968, <i>Journal of Geophysical Research</i>, 73, 635, "Evaluation of the Apollo asteroids as sources of stone meteorites." See: http://adsabs.harvard.edu/abs/1968JGR...73..635W
1968, Mar 14	Apollo NEA 216985 (2000 QK130), $H = 21.3$ mag, $D \approx 200$ m, PHA), passed Earth at a nominal miss distance of 2.54 LD. Minimum miss distance 2.53 LD. See: 2000 QK130 - JPL , 2000 QK130 - SSA See also: 12 Mar 1916, 15 Mar 2036, 15 Mar 2089.
1968, Apr 23	Apollo NEA 2008 GD110 ($H = 24.6$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 0.24 LD. Minimum miss distance 0.16 LD. [1968-01] See: 2008 GD110 - JPL , 2008 GD110 - SSA
1968, May 15	Aten NEA 2010 JR34 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.91 LD. [1968-02] See: 2010 JR34 -JPL , 2010 JR34 - SSA
1968, Jun 14	Apollo NEA 1566 Icarus (1949 MA), $H = 16.3$ mag, $D = 1300$ m, PHA) passed Earth at 16.53 LD. Observed by radar by NASA's Goldstone Solar System Radar (CA, USA) and the MIT Haystack Observatory (Westfort, MA, USA). See: 1949 MA - JPL , 1566 Icarus - SSA See also: http://en.wikipedia.org/wiki/1566_Icarus Ref: - R.M. Goldstein, 1968, <i>Science</i>, 162, 903, "Radar observations of Icarus." See: http://adsabs.harvard.edu/abs/1968Sci...162..903G

	- B.G. Marsden, 1998, <i>Boston Sunday Globe</i>, 29 March 1989, "How the asteroid story hit: an astronomer reveals how a discovery spun out of control." See: http://www.minorplanetcenter.net/iau/pressinfo/1997XF11Globe.html See also: 16 Jun 2015, 14 Jun 2090.
1968, Nov 30	Apollo NEA 2018 WE3 ($H = 21.2$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 7.28 LD. Minimum miss distance 7.17 LD. See: 2018 WE3 - SSA , 2018 WE3 - JPL
1968, Dec 16	Apollo NEA 2015 XA378 ($H = 25.9$ mag, $D \approx 23$ m) passed Earth at a nominal miss distance of 2.76 LD. Minimum miss distance 0.62 LD. See: 2015 XA378 - SSA , 2015 XA378 - JPL See also: 1 June 2053.
1968, Dec 28	Aten NEA 2014 YW14 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.60 LD. [1968-03] See: 2014 YW14 - JPL , 2014 YW14 - SSA
1969 , Jan 31	Aten NEA 2019 BE5 ($H = 25.1$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 5.11 LD. Minimum miss distance 0.30 LD. See: 2019 BE5 - JPL , 2019 BE5 - SSA
1969, Feb 8	Chihuahua Fireball, witnessed falling over the Mexican State of Chihuahua. After breaking up in the atmosphere, an extensive search for pieces was conducted; it is often described as "the best-studied meteorite in history." Some 2000 kg of meteorite material has been collected. The largest piece found, the Allende meteorite of 0.520 kg, is notable for possessing abundant, large calcium-aluminum-rich inclusions, which are among the oldest objects formed in the Solar System. The $^{238}\text{U}/^{235}\text{U}$ isotope ratio found in the Allende meteorite by Brennecka et al. (2010) implies that the Solar System is some 5 million years younger than thought previously. See : http://en.wikipedia.org/wiki/Allende_meteorite Ref: - G.A. Brennecka, S. Weyer, M. Wadhwa, et al., 2010, <i>Science</i>, 327, 449, "$^{238}\text{U}/^{235}\text{U}$ variations in meteorites: extant ^{247}Cm and implications for Pb-Pb dating." See: http://www.sciencemag.org/content/327/5964/449 - Chi Ma, O. Tschauner, J.R. Beckett, et al., 2012, <i>American Mineralogist</i>, 97, 1219, "Panguite, $(\text{Ti}^{4+}, \text{Sc}, \text{Al}, \text{Mg}, \text{Zr}, \text{Ca})_{1.8}\text{O}_3$, a new ultra-refractory titania mineral from the Allende meteorite: synchrotron micro-diffraction and EBSD."

	See: http://www.its.caltech.edu/~chima/publications/2012_AM_buseckite.pdf http://media.caltech.edu/press_releases/13524
1969, Apr 12	Apollo NEA 2019 FV ($H = 24.0$ mag, $D \approx 60$ m) passed Earth at a nominal miss distance of 9.27 LD. Minimum miss distance 0.96 LD. See: 2019 FV – SSA , 2019 FV – JPL
1969, Apr 15	Apollo NEA 2021 TG14 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 8.43 LD. Minimum miss distance 0.91 LD. See: 2021 TG14 – S2P , 2021 TG14 – JPL See also: 15 Apr 1978 , 18 Oct 2021 .
1969, Aug 4	Apollo NEA 2020 NK1 ($H = 19.0$ mag, $D \approx 600$ m, PHA) passed Earth at a nominal miss distance of 7.83 LD. Minimum miss distance 6.65 LD. See: 2020 NK1 – S2P , 2020 NK1 - JPL See also: 4 Aug 2043 .
1969, Aug 27	Apollo NEA 192642 (1999 RD32) , $H = 16.7$ mag, $D \approx 1600$ m, PHA) passed Earth at a nominal miss distance of 3.63 LD. Minimum miss distance 3.62 LD. See: 1999 RD32 - JPL , 1999 RD32 - SSA See also: https://en.wikipedia.org/wiki/(192642)_1999_RD32
1969, Sep 8	Aten NEA 2021 RQ2 ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 1.33 LD. Minimum miss distance 0.05 LD. See: 2021 RQ2 – S2P , 2021 RQ2 - JPL See also: 9 Sep 2021 .
1969, Sep 28	Murchison Fireball and Meteorite . Near the town of Murchison (Victoria, Australia), a bright fireball was observed to separate into three fragments before disappearing, leaving a cloud of smoke. About 30 seconds later, a tremor was heard. Many specimens were found over an area larger than 13 km ² , with individual masses up to 7 kg; one piece, weighing 680 g, broke through a roof. The total collected mass exceeds 100 kg. Ref: - P. Schmitt-Kopplin, Z. Gabelica, R.D. Gougeon, et al., 2010, <i>Proc. Nat Acad. Sci. USA</i> , 107, 2763, "High molecular diversity of extraterrestrial organic matter in Murchison meteorite revealed 40 years after its fall." See: http://www.pnas.org/content/early/2010/02/12/0912157107.abstract - S. Pizzarello, August 2012, <i>Astrophysical Journal</i> (Letters), 754, L27, "Hydrogen cyanide in the Murchison Meteorite ." See: http://adsabs.harvard.edu/abs/2012ApJ...754L..27P

	See also: http://tin.er.usgs.gov/meteor/metbull.php?code=16875 http://www.scientificamerican.com/article.cfm?id=murchison-meteorite http://en.wikipedia.org/wiki/Murchison_meteorite
1969, Dec	The Japanese Antarctic Research Expedition discovered nine meteorites on the blue ice field of the Yamato Mountains in Antarctica, December 1969. This was the first significant recovery of Antarctic meteorites and represented samples of several different types. In 2011, co-researchers from the USA, South Korea and Japan have found in meteorite Yamato 691 a new mineral, dubbed "Wassonite", formed from sulfur and titanium, and possessing a unique crystal structure that has not been previously observed in nature. Ref: - T. Nagata, 30 June 1976, <i>Meteoritics</i>, 11, 181, "Yamato meteorites collected in Antarctica in 1969." See: http://adsabs.harvard.edu/abs/1976Metic..11..181N http://www.nasa.gov/centers/johnson/home/wassonite.html
1970, Jan 1	27 NEAs known, of which 10 PHAs. See: http://neo.jpl.nasa.gov/stats/
1970	First infrared diameter of an asteroid measured: 4 Vesta ($H = 3.40$ mag, $D = 530$ km, Main-belt asteroid). See: Vesta - JPL , 4 Vesta - SSA See also: http://en.wikipedia.org/wiki/4_Vesta Ref: - D.A. Allen, 1970, <i>Nature</i>, 227, 158, "Infrared diameter of Vesta." See: http://nature.com/nature/journal/v227/n5254/abs/227158a0.html
1970, Jan 3	Lost City Fireball. Four stations (Hominy OK, Woodward OK, Pleasanton KS, and Garden City KS) of the Prairie Meteorite Network simultaneously photographed the track of a meteoroid fireball. Analysis of the photographs indicated that a meteorite might have landed within an area east of Lost City (OK, USA). This was the first time in the US that simultaneous photography of a fireball from multiple observation points was achieved, making it possible to calculate a trajectory and delimit a search area on the ground. Six days later, a 9.83 kg (21.6 pound) meteorite was spotted sitting in a snow-covered dirt road within one-half mile of Lost City. Three additional smaller meteorite fragments were recovered later (272 g, 640 g, 6.6 kg). Ref: - Z. Ceplecha, 1996, <i>Astronomy & Astrophysics</i>, 311, 329, "Luminous efficiency based on photographic observations of the Lost City fireball and implications for the influx of interplanetary

	bodies onto Earth." See: http://adsabs.harvard.edu/abs/1996A%26A...311..329C http://en.wikipedia.org/wiki/Lost_City,_Oklahoma
1970, Jan 24	C.S. Beals, 1970, <i>Nature</i>, 225, 368, "Impact craters and the relative ages of Earth and Moon." See: http://adsabs.harvard.edu/abs/1970Natur.225..368B
1970, Jan 31	Aten NEA 2006 AM4 ($H = 21.7$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 4.18 LD. Minimum miss distance 4.17 LD. See: 2006 AM4 - SSA , 2006 AM4 - JPL
1970, Feb 26	Apollo NEA 2019 DS1 ($H = 25.6$ mag, $D \approx 26$ m) passed Earth at a nominal miss distance of 0.94 LD. Minimum miss distance 0.93 LD. [1970-01] See: 2019 DS1 - SSA , 2019 DS1 - JPL See also: 26 Feb 2082.
1970, Mar 27	Apollo NEA 215588 (2003 HF2, $H = 19.3$ mag, $D \approx 490$ m, PHA) passed Earth at a nominal miss distance of 4.02 LD. Minimum miss distance 4.02 LD. See: 2003 HF2 - JPL , 2003 HF2 - SSA
1970, May 7	Apollo NEA 2019 JJ3 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 3.94 LD. Minimum miss distance 0.43 LD. See: 2019 JJ3 - SSA , 2019 JJ3 - JPL See also: 13 May 2095.
1970, Oct	C.J. van Houten, I. van Houten-Groeneveld, P. Herget & T. Gehrels, 1970, <i>Astronomy & Astrophysics Suppl.</i>, 2, 339, "The Palomar-Leiden Survey of faint Minor Planets." See: http://adsabs.harvard.edu/abs/1970A%26AS....2..339
1971 , Jan 22	Aten NEA 2020 BP8 ($H = 25.6$ mag, $D \approx 28$ m) passed Earth at a nominal miss distance of 7.14 LD. Minimum miss distance 0.88 LD. See: 2020 BP8 - S2P , 2020 BP8 - JPL
1971, Feb 4	Aten NEA 2016 CE ($H = 28.7$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.58 LD. [1971-01] See: 2016 CE - JPL , 2016 CE - SSA See also: 5 Feb 2056.
1971, Mar 6-10	IAU Colloquium No. 12 on Physical Studies of Minor Planets, Tucson (AZ, USA), 6-10 March 1971. Proceedings: T. Gehrels (ed.),

	1971, NASA SP-267, "Physical studies of minor planets." See: http://adsabs.harvard.edu/abs/1971NASSP.267.....G
1971, Mar 24	Aten NEA 234145 (2000 EW70 , $H = 21.9$ mag, $D \approx 344$ m, PHA), passed Earth at a nominal miss distance of 4.61 LD. Minimum miss distance 4.61 LD. See: 2000 EW70 - JPL , 2000 EW70 - SSA See also: 24 Mar 1961 .
1971, Apr 2	Aten NEA 2015 FA285 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 5.77 LD. Minimum miss distance 0.73 LD. See: 2015 FA285 - JPL , 2015 FA285 - SSA
1971, Apr 3	Aten NEA 2014 GC49 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 9.14 LD. Minimum miss distance 0.64 LD. See: 2014 GC49 - JPL , 2014 GC49 - SSA
1971, Apr 11	Apollo NEA 2002 JE9 ($H = 21.2$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.65 LD. [1971-02] See: 2002 JE9 - JPL , 2002 JE9 - SSA See also: http://en.wikipedia.org/wiki/2002_JE9
1971, May 11	Aten NEA 2021 JZ5 ($H = 28.4$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 2.93 LD. Minimum miss distance 0.89 LD. See: 2021 JZ5 – S2P , 2021 JZ5 - JPL See also: 11 May 2034 .
1971, May 20	Aten NEA 2021 JY3 ($H = 28.4$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.56 LD. Minimum miss distance 0.52 LD. [1971-03] See: 2021 JZ5 – S2P , 2021 JZ5 - JPL See also: 16 May 2052 , 8 May 2059 .
1971, May 23	Apollo NEA 2020 KQ4 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 2.71 LD. Minimum miss distance 0.63 LD. See: 2020 KQ4 – S2P , 2020 KQ4 – JPL See also: 24 May 2031 .
1971, Jul 20	Apollo NEA 2002 BF25 ($H = 22.2$ mag, $D \approx 152$ m) passed Earth at a nominal miss distance of 7.66 LD. Minimum miss distance 7.66 LD. See: 2002 BF25 - SSA , 2002 BF25 - JPL See also: 20 Jul 2020 .
1971, Oct 2	Apollo NEA 2008 TC3 ($H = 30.3$ mag, $D \approx 4.1$ m) passed Earth at a

	nominal miss distance of 15.26 LD. Minimum miss distance 14.01 LD. See: 2008 TC3 - JPL , 2008 TC3 - SSA See also: 4 Oct 1917, 11 Oct 1961, 27 Jan 1988, 6 Oct 2008.
1972	V.L. Masajtis, M.V. Mikhajlov, T.V. Selivanovskaya, 1972, <i>Meteoritics</i> , 7(1), 39, "The Popigay meteorite crater ." See: http://adsabs.harvard.edu/abs/1972IGRv...14..327M
1972	V.L. Masaitis, M.V. Mikhailov, T.V. Selivanovskaya, 1972, <i>Int. Geol. Rev.</i> , 14, 327, " Popigai Basin -- an explosion meteorite crater ." See: http://adsabs.harvard.edu/abs/1972Metic...7...39M
1972, Mar	D.J. Milton, B.C. Barlow, R. Brett, et al., 1972, <i>Science</i> , 175, 1199, "Gosses Bluff impact structure, Australia." See: http://adsabs.harvard.edu/abs/1972Sci...175.1199M http://en.wikipedia.org/wiki/Gosses_Bluff_crater
1972, Mar 17	Apollo NEA 2021 RP2 ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.21 LD. Minimum miss distance 0.08 LD. [1972-01] See: 2021 RP2 – S2P , 2021 RP2 – JPL
1972, Jun 9	Aten NEA 2021 LK6 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 7.04 LD. Minimum miss distance 0.82 LD. See: 2021 LK6 – S2P , 2021 LK6 – JPL See also: 9 Jun 2085.
1972, Aug 6	Apollo NEA 2018 LB1 ($H = 20.2$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 3.67 LD. Minimum miss distance 2.57 LD. See: 2018 LB1 - JPL , 2018 LB1 - SSA
1972, Aug 10	Great Daylight 1972 Fireball (US19720810) , Earth-grazing asteroid, estimated $D \approx 3$ -14 m, 100-sec passage with 15 km/s through the Earth atmosphere, 57 km high over the Rocky Mountains from Utah (USA) to Alberta (Canada). Co-inciding with the annual Perseid meteor shower. Suggestions that this object is still in an Earth crossing orbit around the Sun and passed close to the Earth again in August 1997 have not been substantiated (Spahr, 2010, private communication). Ref: - R.D. Rawcliffe, C.D. Bartky, F. Li, et al., 1974, <i>Nature</i> , 247, 449, "Meteor of August 10, 1972." See: http://adsabs.harvard.edu/abs/1974Natur.247..449R

	- E.J. Öpik, 1974, <i>Irish Astronomical Journal</i>, 11, 165, "A meteorite that got away." See: http://adsabs.harvard.edu/abs/1974IrAJ...11..165O - A.C. Clarke, 1993, in preface of his novel <i>The Hammer of God</i> (New York: Bantam Books). See: http://en.wikipedia.org/wiki/The_Hammer_of_God - E. Tagliaferri, 1998, <i>Mercury</i>, Vol. 27, no. 6, p. 18, "Observation of meteoroid impacts by space-based sensors." See: http://adsabs.harvard.edu/abs/1998Mercu..27f..18T - Z. Ceplecha, 1994, <i>Astronomy & Astrophysics</i>, 283, 287, "Earth-grazing daylight fireball of August 10, 1972." See: http://adsabs.harvard.edu/abs/1994A%26A...283..287C See also: http://web.archive.org/web/20050120051405/www.maa.agleia.de/Comet/Other/1972.html http://apod.nasa.gov/apod/ap090302.html http://en.wikipedia.org/wiki/The_Great_Daylight_1972_Fireball http://en.wikipedia.org/wiki/Earth-grazing_fireball
1972, Oct 2	R.J. Ford, 1972, <i>Earth and Planetary Science Letters</i>, 16, 228, "A possible impact crater associated with Darwin glass." See: http://adsabs.harvard.edu/abs/1972E&PSL..16..228F See also: http://www.newscientist.com/article/dn24560-meteor-impact-trapped-ancient-swamp-plants-in-glass.html#.UpZU6rB3tdg
1972, Dec 22	Aten NEA 2021 LF6 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.97 LD. Minimum miss distance 0.92 LD. [1972-02] See: 2021 LF6 – S2P , 2021 LF6 – JPL See also: 8 Jan 1924.
1973, Jan	Eleanor F. Helin and Eugene M. Shoemaker begin photographic NEO searches using Palomar 46 cm (18 inch) telescope: the Planet-Crossing Asteroid Survey (PCAS), 1973 – 1978. They took photographic plates 3 nights each month till 1978 and found first Earth orbit crosser: Apollo NEA 5496 (1973 NA), $H = 15.9$ mag, $D \approx 2.73$ km) on 4 July 1973. See: 1973 NA - JPL , 5496 1973 NA - SSA See also: https://en.wikipedia.org/wiki/(5496)_1973_NA Ref: - E.F. Helin, E.M. Shoemaker, 1979, <i>Icarus</i>, 40, 321, "The Palomar Planet-Crossing Asteroid Survey, 1973 – 1978." See: http://adsabs.harvard.edu/abs/1979Icar...40..321H http://en.wikipedia.org/wiki/Planet-Crossing_Asteroid_Survey

1973, Jan 17	Aten NEA 2009 BH2 ($H = 22.3$ mag, $D \approx 130$ m) passed Earth at a nominal miss distance of 5.50 LD. Minimum miss distance 5.50 LD. See: 2009 BH2 - JPL , 2009 BH2 - SSA
1973, Feb	J.K. Bjorkman, 1973, <i>Meteoritics</i> , 8, 91, "Meteors and meteorites in the ancient Near East." See: http://adsbit.harvard.edu/cgi-bin/nph-article_query?bibcode=1973Metic...8...91B&db_key=AST&page_ind=0&plate_select=NO&data_type=GIF&type=SCREEN_GIF&classic=YES
1973, Mar 13	Discovery of Amor NEA 1943 Anteros (1973 EC , $H = 15.9$ mag, $D \approx 2480$ m). See: 1973 EC - JPL , 1973 EC - SSA See also: https://en.wikipedia.org/wiki/1943_Anteros See also: 6 February 2015 , 23 May 2038 , 20 May 2050 .
1973, Apr 21	Apollo NEA 2020 HQ4 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 4.29 LD. Minimum miss distance 0.70 LD. See: 2020 HQ4 – S2P , 2020 HQ4 – JPL
1973, Sep 18	Aten NEA 2017 RX2 ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 3.85 LD. Minimum miss distance 0.42 LD. See: 2017 RX2 - JPL , 2017 RX2 - SSA
1973, Oct	P.D. Zimmerman, G.W. Wetherill, 1973, <i>Science</i> , 182, 51, "Asteroidal source of meteorites." See: http://adsabs.harvard.edu/abs/1973Sci...182...51Z
1973, Dec 19	Aten NEA 2017 YO3 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 2.35 LD. Minimum miss distance 0.62 LD. See: 2017 YO3 - JPL , 2017 YO3 - SSA See also: 20 Dec 2064 .
1974 , Feb 12	Aten NEA 2017 CP32 ($H = 23.8$ mag, $D \approx 60$ m) passed Earth at a nominal miss distance of 3.88 LD. Minimum miss distance 0.38 LD. See: 2017 CP32 - JPL , 2017 CP32 - SSA See also: 12 Feb 2061 .
1974, Mar 16	Apollo NEA 2012 EN5 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 2.25 LD. Minimum miss distance 0.31 LD. See: 2012 EN5 -JPL , 2012 EN5 - SSA
1974, May 6	Apollo NEA 2014 HB177 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 1.37 LD. Minimum miss distance 0.075 LD (0.45 R_{Earth} from the geocenter).

	See: 2014 HB177 - SSA , 2014 HB177 - JPL See also: 6 May 2034 .
1974, Dec 16	Apollo NEA 3200 Phaethon (1983 TB , $H = 14.4$ mag, $D \approx 5100 \pm 200$ m, PHA , causing the annual Geminids meteor shower) passed Earth at a nominal miss distance of 21.30 LD (= 0.05 au). Minimum miss distance 21.30 LD. See: 3200 Phaethon - SSA , 1983 TB - JPL Ref: - T. Kasuga, J.-I. Watanabe, M. Sato, 2006, <i>Monthly Notices of the Royal Astronomical Society</i> , 373, 1107, "Benefits of an impact mission to 3200 Phaethon : nature of the extinct comet and artificial meteor shower." See: http://adsabs.harvard.edu/abs/2006MNRAS.373.1107K See also: https://www.jpl.nasa.gov/news/news.php?feature=7030 https://phys.org/news/2017-12-arecibo-radar-asteroid-phaethon-images.html http://en.wikipedia.org/wiki/3200_Phaethon See also: https://www.space.com/42236-weird-blue-asteroid-phaethon.html See also: 16 Dec 2017 , 14 Dec 2093 .
1975	G.W. Wetherill, 1975, in: Proc. 6 th Lunar Science Conference, Houston (TX, USA), 17-21 March 1975, Vol. 2 (New York: Pergamon Press, Inc.), p. 1539, "Late heavy bombardment of the moon and terrestrial planets." See: http://adsabs.harvard.edu/abs/1975LPSC....6.1539W
1975, Jan 14	Aten NEA 2018 AS2 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 3.72 LD. Minimum miss distance 0.25 LD. See: 2018 AS2 - JPL , 2018 AS2 - SSA
1975, Jan 23	Amor NEA 433 Eros (A898 PA , $H = 10.3$ mag, $D = 34.4 \times 11.2 \times 11.2$ km, orbital $P = 1.76$ yr), passed Earth at 59 LD (= 0.15 AU). See: 433 Eros - JPL , 433 Eros - SSA See also: http://en.wikipedia.org/wiki/433_Eros See also: 13 Aug 1898 , 31 Jan 2012 .
1975, Jan 31	Apollo NEA 27002 (1998 DV9 , $H = 18.2$ mag, $D \approx 700$ m, PHA) passed Earth at a nominal miss distance of 1.76 LD. Minimum miss distance 1.76 LD. See: 1998 DV9 - JPL , 1998 DV9 - SSA
1975, Mar 25	Aten NEA 2012 FT35 ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 2.88 LD. Minimum miss distance 0.96 LD.

	See: 2012 FT35 - JPL , 2012 FT35 - SSA See also: 29 Mar 1925 .
1975, Apr 19	Apollo NEA 2018 HW1 ($H = 25.8$ mag, $D \approx 25$ m) passed Earth at a nominal miss distance of 6.60 LD. Minimum miss distance 0.63 LD. See: 2018 HW1 – SSA , 2018 HW1 - JPL See also: 21 Apr 2018 , 24 Apr 2041 .
1975, Apr 26	Apollo NEA 2020 HF5 ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 7.24 LD. Minimum miss distance 0.11 LD. See: 2020 HF5 – S2P , 2020 HF5 - JPL See also: 22 Apr 2020 , 26 Apr 2079 .
1975, Jul 1	Aten NEA 2021 LD6 ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.31 LD. Minimum miss distance 0.21 LD. [1975-01] See: 2021 LD6 – S2P , 2021 LD6 – JPL See also: 26 Jun 2079 .
1975, Sep	A. Ben-Menahem, 1975, <i>Physics of the Earth and Planetary Interiors</i> , 11, 1, "Source parameters of the Siberian explosion of June 30, 1908 , from analysis and synthesis of seismic signals at four stations." See: http://adsabs.harvard.edu/abs/1975PEPI...11....1B
1975, Nov 6	Apollo NEA 2016 VZ1 ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 9.65 LD. Minimum miss distance 0.87 LD. See: 2016 VZ1 – S2P , 2016 VZ1 – JPL
1975, Nov 11	Apollo NEA 2008 XA2 ($H = 21.6$ mag, $D \approx 170$ m, PHA) passed Earth at a nominal miss distance of 3.25 LD. Minimum miss distance 3.25 LD. See: 2008 XA2 - SSA , 2008 XA2 - JPL
1976	D. Morrison, 1976, <i>Astronomy</i> , 4, no. 6, p. 6, "Asteroids." See: http://adsabs.harvard.edu/abs/1976Ast.....4f...6M
1976, Jan 7	First discovery of an Earth orbit crossing Aten NEA: 2062 Aten (1976 AA) , $H = 17.2$ mag, $D = 1300$ m), by Eleanor F. Helin (1932 – 2009, USA). See: 1976 AA - JPL , 2062 Aten - SSA See also: http://en.wikipedia.org/wiki/2062_Aten Ref: - E.F. Helin, E.M. Shoemaker, 1977, <i>Icarus</i> , 31, 415, "Discovery of asteroid 1976 AA ".

	See: http://adsabs.harvard.edu/abs/1977Icar...31..415H
1976, Jan 16	Apollo NEA 2008 RM98 ($H = 20.8$ mag, $D \approx 250$ m, PHA) passed Earth at a nominal miss distance of 2.18 LD. Minimum miss distance 2.17 LD. See: 2008 RM98 - JPL , 2008 RM98 - SSA
1976, Jan 28	Gujarat Brilliant Fireball and Dhajala Meteorite Shower , India. Ref: - N. Bhandari, D. Lal, J.R. Trivedi, 1976, <i>Meteoritics</i> , 11, 137, "The Dhajala meteorite shower." See: http://adsabs.harvard.edu/abs/1976Metic..11..137B
1976, Mar 8	Jilin Meteorite Shower , near Jilin City (Jilin Province, China), had a dispersion ellipse of 72×8.5 km and landed over 100 fragments with a total mass > 2700 kg. The largest of these fragments weighs 1770 kg and presents the largest stony meteorite known. Ref: - K. Yau, P. Weissman, D. Yeomans, 1994, <i>Meteoritics</i> , 29, 864, "Meteorite falls in China and some related human casualty events." See: http://adsabs.harvard.edu/abs/1994Metic..29..864Y http://www.daviddarling.info/encyclopedia/J/Jilin.html http://en.wikipedia.org/wiki/Meteorite_fall
1976, Mar 29	Apollo NEA 2014 GY44 ($H = 25.7$ mag, $D \approx 26$ m) passed Earth at a nominal miss distance of 1.07 LD. Minimum miss distance 0.10 LD. See: 2014 GY44 - JPL , 2014 GY44 - SSA
1976, Jun 7	Apollo NEA 2019 LW4 ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 1.10 LD. Minimum miss distance 0.97 LD. See: 2019 LW4 - SSA , 2019 LW4 - JPL See also: 8 Jun 2019 , 9 Jun 2074 .
1976, Jun 29	Aten NEA 2021 NM ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 5.36 LD. Minimum miss distance 0.51 LD. See: 2021 NM – S2P , 2021 NM – JPL See also: 29 Jun 1965 .
1976, Oct 17	Aten NEA 2013 UG1 ($H = 22.5$ mag, $D \approx 110$ m) passed Earth at a nominal miss distance of 0.85 LD. Minimum miss distance 0.85 LD. [1976-01] See: 2013 UG1 - JPL , 2013 UG1 - SSA See also: 17 Oct 2065 .
1976, Oct 20	Aten NEA 2340 Hathor (1976 UA , $H = 20.5$ mag, $D \approx 210$ m, PHA) passed Earth at a nominal miss distance of 3.02 LD. Minimum miss

	distance 3.02 LD. See: 1976 UA - JPL , 1976 UA - SSA See also: 20 Oct 1921, 21 Oct 2069, 21 Oct. 2086.
1976, Dec	Z. Ceplecha, R.E. McCrosky, 1976, <i>Journal of Geophysical Research</i>, 81, 6257, "Fireball end heights – a diagnostic for the structure of meteoric material." See: http://adsabs.harvard.edu/abs/1976JGR....81.6257C
1976, Dec 27	Aten NEA 2010 XC15 ($H = 21.6$ mag, $D \approx 170$ m, PHA) passed Earth at a nominal miss distance of 2.43 LD. Minimum miss distance 2.43 LD. See: 2010 XC15 - JPL , 2010 XC15 - SSA See also: 26 Dec 1907, 27 Dec 1914, 27 Dec 2022, 28 Dec 2059, 26 Dec 2064, 26 Dec 2096.
1977, Jan 29	Apollo NEA 292220 (2006 SU49, $H = 19.7$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 3.87 LD. Minimum miss distance 3.86 LD. See: 2006 SU49 - JPL , 2006 SU49 - SSA See also: 30 Jan 1982, 28 Jan 2029. See also: https://en.wikipedia.org/wiki/(292220)_2006_SU49
1977, Apr 11	Apollo NEA 2011 UH20 ($H = 21.1$ mag, $D \approx 220$ m, PHA) passed Earth at a nominal miss distance of 4.57 LD. Minimum miss distance 4.57 LD. See: 2011 UH20 - JPL , 2011 UH20 - SSA See also: 11 Apr 1906.
1977, May 7	Apollo NEA 2018 VO6 ($H = 24.3$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 2.71 LD. Minimum miss distance 0.60 LD. See: 2007 VO6 - SSA , 2007 VO6 - JPL See also: 7 May 2058, 8 May 2063.
1977, Jun 8	Amor NEA 2020 KB3 ($H = 24.9$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 4.10 LD. Minimum miss distance 0.87 LD. See: 2020 KB3 – S2P , 2020 KB3 – JPL
1977, Jul 21	Apollo NEA 2021 BN, $H = 28.3$ mag, $D \approx 8$ m passed Earth at a nominal miss distance of 8.83 LD. Minimum miss distance 0.95 LD. See: 2021 BN – S2P , 2021 BN – JPL See also: 28 Jul 2064.
1977, Sep 13	Apollo NEA 2012 EP10 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 3.43 LD. Minimum miss distance 0.21 LD. See: 2012 EP10 - JPL , 2012 EP10 - SSA

1978	C.R. Chapman, J.G. Williams, W.K. Hartmann, 1978, <i>Annual Review of Astronomy & Astrophysics</i> , 16, 33, "The asteroids." See: http://adsabs.harvard.edu/abs/1978ARA%26A..16...33C
1978	L'. Kresák, 1978, <i>Bulletin Astronomical Institutes of Czechoslovakia</i> , 29, 103, "Passages of comets and asteroids near the earth." See: http://adsabs.harvard.edu/abs/1978BAICz..29..103K
1978	L'. Kresák, 1978, <i>Bulletin Astronomical Institutes of Czechoslovakia</i> , 29, 114, "The comet and asteroid population of the earth's environment." See: http://adsabs.harvard.edu/abs/1978BAICz..29..114K
1978	L'. Kresák, 1978, <i>Bulletin Astronomical Institutes of Czechoslovakia</i> , 29, 149, "The total number of the Apollo asteroids and their chance rediscoveries." See: http://adsabs.harvard.edu/abs/1978BAICz..29..149K
1978	B.L. Narendra, 1978, <i>Discovery</i> 13(1), 10, "The Peabody Museum meteorite collection: a historic account." See: http://peabody.yale.edu/collections/meteorites-and-planetary-science/weston-meteorite http://peabody.yale.edu/collections/meteorites-and-planetary-science/wethersfield-meteorite
1978	G.L. Verschuur, 1978, <i>Cosmic Catastrophes</i> (Reading, MA, USA: Addison-Wesley Publ. Co.). See: http://adsabs.harvard.edu/abs/1978coca.book....V
1978, Apr 1	IAU Minor Planet Center moved to Smithsonian Astrophysical Observatory, Cambridge (MA, USA). Brian G. Marsden, director. Up to this time, the set of numbered minor planets had increased to 2060, with nearly 180,000 observations in the archive. See: http://www.oaa.gr.jp/~oaacs/mp/BriefHistoryofMPCbyConradBardwell.pdf http://www.iau.org/static/publications/IB104.pdf , p. 67.
1978, Apr 15	Apollo NEA 2021 TG14 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 9.64 LD. Minimum miss distance 0.9963 LD. See: 2021 TG14 – S2P , 2021 TG14 – JPL See also: 15 Apr 1969 , 18 Oct 2021 .
1978, May 20 02:43	Apollo NEA 2017 KY4 ($H = 24.5$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 7.81 LD. Minimum miss distance 0.57 LD.

	See: 2017 KY4 - JPL , 2017 KY4 - SSA
1978, May 20 12:48	Aten NEA 2011 UD21 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 2.48 LD. Minimum miss distance 0.31 LD. See: 2011 UD21 - JPL , 2011 UD21 - SSA
1978, Jul 1	Apollo NEA 436724 (2011 UW158, PHA) passed Earth at a nominal miss distance of 4.68 LD. Minimum miss distance 4.68 LD. See: 2011 UW158 - JPL , 2011 UW158 - SSA See also: https://en.wikipedia.org/wiki/(436724)_2011_UW158 See also: 2 Jul 2108 .
1978, Sep	E. Bowell, C.R. Chapman, J.C. Grady, D. Morrison, B. Zellner, 1978, <i>Icarus</i> , 35, 313, "Taxonomy of asteroids." See: http://adsabs.harvard.edu/abs/1978Icar...35..313B
1978, Oct 20	Apollo NEA 2017 UJ2 ($H = 31.0$ mag, $D \approx 2.2$ m) passed Earth at a nominal miss distance of 2.05 LD. Minimum miss distance 0.40 LD. See: 2017 UJ2 - SSA , 2017 UJ2 - JPL See also: 20 Oct 2017 , 30 Oct 2030 .
1979	T. Gehrels (ed.), 1979, <i>Asteroids I</i> (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/1979aste.book.....G
1979	E.J. Öpik, 1979, <i>Irish Astronomical Journal</i> , 14, 31, "Dinosaurs." See: http://adsabs.harvard.edu/abs/1979IrAJ...14Q..31O
1979, Jan 5	Apollo NEA 2018 BM3 ($H = 22.0$ mag, $D \approx 140$ m, PHA) passed Earth at a nominal miss distance of 2.90 LD. Minimum miss distance 2.29 LD. See: 2018 BM3 - JPL , 2018 BM3 - SSA See also: 5 Jan 2051 .
1979, Feb	R.D. Rawcliffe, 1979, <i>Astrophysical Journal</i> , 228, 338, "Satellite observations of meteors." See: http://adsabs.harvard.edu/abs/1979ApJ...228..338
1979, Mar	G.W. Wetherill, 1979, <i>Scientific American</i> , 240, No. 3, 38, "Apollo objects." See: http://adsabs.harvard.edu/abs/1979SciAm.240...54W
1979, Aug 17	Apollo NEA 2017 RV ($H = 21.9$ mag, $D \approx 150$ m, PHA) passed Earth at a nominal miss distance of 4.20 LD. Minimum miss distance 4.19 LD. See: 2017 RV - JPL , 2017 RV - SSA

	See also: 19 Aug 2125, 19 Aug 2175.
1979, Sep 2	Apollo NEA 2014 WX202 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.87 LD. Minimum miss distance 0.86 LD. [1979-01] See: 2014 WX202 - JPL , 2014 WX202 - SSA See also: 7 Dec 2014.
1979, Sep 22	The Vela Incident. Double flash explosion detected by an American Vela Hotel satellite over the South Atlantic caused by nuclear weapons test or meteoroid? See: http://en.wikipedia.org/wiki/Vela_Incident
1979, Nov	W.M. Napier, S.V.M. Clube, 1979, <i>Nature</i> , 282, 455, "A theory of terrestrial catastrophism." See: http://adsabs.harvard.edu/abs/1979Natur.282..455N
1979, Dec	E.F. Helin, E.M. Shoemaker, 1979, <i>Icarus</i> , 40, 321, "The Palomar planet-crossing asteroid survey , 1973-1978." See: http://adsabs.harvard.edu/abs/1979Icar...40..321H
1979, Dec	H.H. Nininger, 1979, <i>Meteoritics</i> , 14, 497, "Small asteroids frequently arrive on the Earth." See: http://adsabs.harvard.edu/abs/1979Metic..14..497N
1979, Dec 17	Apollo NEA 1979 XB ($H = 18.5$ mag, $D \approx 700$ m, PHA) passed Earth at a nominal miss distance of 14.24 LD. Minimum miss distance 11.30 LD. See: 1979 XB - JPL , 1979 XB - SSA This asteroid may make a close Earth flyby on 14 Dec 2113.
1980, Jan 1	51 NEAs known, of which 17 PHAs. See: http://neo.jpl.nasa.gov/stats/
1980	Spacewatch program started by Tom Gehrels and Robert S. McMillan, LPL, UA, Tucson (AZ, USA). Routine detections started in 1984, survey started in 1989. CCD-scanning observations are conducted 20 nights each lunation with the Steward Observatory 0.9-m Spacewatch Telescope (down to $v = 21$ mag) and the Spacewatch 1.8-m telescope (down to $v = 23$ mag), both on Kitt Peak (AZ, USA). From 1992 to 1995 Spacewatch automatically detected more than 60,000 asteroids down to $v = 21$ mag. See: http://spacewatch.lpl.arizona.edu/ Ref: - R.S. McMillan and The Spacewatch Team, 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symposium

	No. 236 on <i>Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i>, Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 329, "Spacewatch preparations for the era of deep all-sky surveys." See: http://adsabs.harvard.edu/abs/2007IAUS..236..329M - D.K. Yeomans, S.R. Chesley, P.W. Chodas, 2010, in: A.M. Finkelstein, W.F. Huebner & V.A. Shor (eds.), <i>Proc. Intern. Conf. Asteroid-Comet Hazard 2009, Protecting the Earth against collisions with asteroids and comet nuclei</i>, St. Petersburg (Russian Federation), 21-25 September 2009 (Saint Petersburg: Nauka), p. 244, "NASA's Near-Earth Object Program Office." See: http://www.skyandtelescope.com/news/125432648.html - R.S. McMillan, T.H. Bressi, J.V. Scotti, et al., 2012, American Astronomical Society, DPS meeting #44, #210.14, "Spacewatch observations of Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2012DPS....4421014M See also: http://spacewatch.lpl.arizona.edu/ http://en.wikipedia.org/wiki/Spacewatch
1980	E. Helin, D. Morrison, G. Wetherill, M. Hanner, 1980, <i>Sky & Telescope</i>, 60, 12, "IRAS and the asteroids." See: http://adsabs.harvard.edu/abs/1980S%26T....60...12H
1980, Jan 12	L. Alvarez, W. Alvarez, S. Klint, 1980, <i>Science News</i>, 117(2), 22, 12 January 1980, "Asteroid-caused extinctions." Correction: <i>Science News</i>, 117(6), .., 9 February 1980. See: http://www.sciencenews.org/view/feature/id/188305/title/Now_--_Asteroid-Caused_Extinctions http://www.sciencenews.org/view/feature/id/177017/title/Correction_Now_--_Asteroid-Caused_Extinctions http://adsabs.harvard.edu/abs/1980SciN..117...22A
1980, Jan 20	Aten NEA 2018 BH3 ($H = 25.2$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 1.14 LD. Minimum miss distance 0.92 LD. See: 2018 BH3 - JPL , 2018 BH3 - SSA See also: 20 Jan 2060.
1980, Feb 18	Apollo NEA 2021 DG ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 6.01 LD. Minimum miss distance 0.72 LD. See: 2021 DG – S2P , 2021 DG – JPL See also: 18 Feb 2021, 19 Feb 2031.
1980, Apr 15	Apollo NEA 2017 HJ ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 1.47 LD. Minimum miss distance 0.11 LD. See: 2017 HJ – S2P , 2017 HJ – JPL

1980, May 17	Apollo NEA 2009 WW7 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 7.01 LD. Minimum miss distance 0.11 LD. See: 2009 WW7 - JPL , 2009 WW7 - SSA
1980, May 22	J. Smit, J. Hertogen, 1980, <i>Nature</i> , 225, 198, "An extraterrestrial event in the Cretaceous-Tertiary boundary." See: http://adsabs.harvard.edu/abs/1980Natur.285..198S
1980, Jun	Nobel Prize winning physicist Luiz W. Alvarez (1911 – 1988, USA) and colleagues published their seminal paper (1980), associating the extinction of dinosaurs ~65.5 Myr ago with the direct impact of a large asteroid or comet. Ten years later after this initial proposal, evidence of a huge impact crater called Chicxulub , off the coast of Yucatán Peninsula (Mexico), strongly confirmed their theory. The crater center is located near the town Chicxulub. The crater diameter is over 180 km, maybe even 300 km, making the feature one of the largest confirmed impact craters on Earth. The crater was discovered by the geophysicist Glen Penfield, who had been looking for oil in Yucatán during the late-1970s. Returning later he found evidence for the impact theory (A.R. Hildebrand et al., 1991). The impacting NEO that formed the crater had a diameter $D = 10 \pm 4$ km; the explosion released an energy of about 5×10^7 megaton TNT, substantially more powerful than the largest known volcanic eruption. W.F. Bottke et al. (2007) suggested that the impacting NEO was a member of the Baptistina family of asteroids , created by a collision of two main-belt asteroids (with $D = 170$ km and 60 km) 160 Myr ago, the largest surviving orbiting member of which is main-belt asteroid 298 Baptistina ($D = 13$ -30 km), discovered in 1890 by Auguste H. Charlois (1864 – 1910) at the Observatoire de Nice (France). But see Masiero et al. (2011). Schulte et al. (2010) summarized evidence that the Chicxulub impact triggered the mass extinction ~65.5 year ago. Ref: - L. Alvarez, W. Alvarez, S. Klint, 1980, <i>Science News</i> , 117(2), 22, 12 January 1980, "Asteroid-caused extinctions." Correction: <i>Science News</i> , 117(6), .., 9 February 1980. See: http://www.sciencenews.org/view/feature/id/188305/title/Now_--_Asteroid-Caused_Extinctions http://www.sciencenews.org/view/feature/id/177017/title/Correction_Now_--_Asteroid-Caused_Extinctions http://adsabs.harvard.edu/abs/1980SciN..117...22A - J. Smit, J. Hertogen, 1980, <i>Nature</i> , 225, 198, 22 May 1980, "An extraterrestrial event in the Cretaceous-Tertiary boundary." See: http://adsabs.harvard.edu/abs/1980Natur.285..198S - L.W. Alvarez, W. Alvarez, F. Asaro, H.V. Michel, 1980, <i>Science</i> , 208, 1095, 6 June 1980, "Extraterrestrial cause for the Cretaceous–

	Tertiary [K-T] extinction." See: http://adsabs.harvard.edu/abs/1980Sci...208.1095A - J. Smit, J. Hertogen, L.W. Alvarez, W. Alvarez, F. Asaro, H.V. Michel, E.M. Shoemaker, 1980, <i>Sky & Telescope</i>, 80, 188, "Fresh light on an ancient catastrophe – Cretaceous-Tertiary extinction event." See: http://adsabs.harvard.edu/abs/1980S%26T....60R.188S - D.V. Kent, G.C. Reid, R.E. Brown, L.W. Alvarez, et al. 1981, <i>Science</i>, 211, 648, 13 February 1981, "Asteroid extinction hypothesis." See: http://adsabs.harvard.edu/abs/1981Sci...211..648K - J. Smit, G. Klaver, 1981, <i>Nature</i>, 292, 47, 2 July 1981, "Sanadine spherules at the Cretaceous-Tertiary boundary indicate a large impact event." See: http://www.nature.com/nature/journal/v292/n5818/abs/292047a0.html http://adsabs.harvard.edu/abs/1981Natur.292...47S - R.P. Turco, O.B. Toon, C. Park, et al., 2 October 1981, <i>Science</i>, 214, 19, "Tunguska meteor fall of 1908 – effects on stratospheric ozone." See: http://adsabs.harvard.edu/abs/1981Sci...214...19T - R.A.F. Grieve, 2 August 1984, <i>Nature</i>, 310, 370, "Cretaceous-Tertiary extinctions: physical evidence of impact." See: http://adsabs.harvard.edu/abs/1984Natur.310..370G - A.R. Hildebrand, G.T. Penfield, D.A. Kring, et al., 1 September 1991, <i>Geology</i>, 19, 867, "Chicxulub Crater: A possible Cretaceous/Tertiary boundary impact crater on the Yucatán Peninsula, Mexico." See: https://pubs.geoscienceworld.org/gsa/geology/article-abstract/19/9/867/205322/chicxulub-crater-a-possible-cretaceous-tertiary?redirectedFrom=fulltext - K.O. Pope, K.H. Baines, A.C. Ocampo, B.A. Ivanov, December 1994, <i>Earth and Planetary Science Letters</i>, 128, 719, "Impact winter and the Cretaceous/Tertiary extinctions: results of a Chicxulub asteroid impact model." See: http://adsabs.harvard.edu/abs/1994E%26PSL.128..719P - G.L. Verschuur, 1996, <i>Impact! The threat of comets and asteroids</i> (Oxford: OUP), Ch.2 "The saga of the Chicxulub Crater." See: http://adsabs.harvard.edu/abs/1996itca.book.....V - P. Claeys, S. Goderis, 6 September 2007, <i>Nature</i>, 449, 30, "Lethal billiards." See: http://adsabs.harvard.edu/abs/2007Natur.449...30C - W.F. Bottke, D. Vokrouhlický, D. Nesvorný, et al., 6 September 2007, <i>Nature</i>, 449, 48, "An asteroid breakup 160 Myr ago as the probable source of the K/T impactor." See: http://adsabs.harvard.edu/abs/2007Natur.449...48B - D.J. Majaess, D. Higgins, L.A. Molnar, et al., February 2009, <i>Journal of the Royal Astronomical Society of Canada</i>, 103, 7, "New constraints on the asteroid 298 Baptistina, the alleged family member of the K/T impactor."

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	crater.html http://www.space.com/20354-dinosaur-extinction-caused-by-comet.html http://en.wikipedia.org/wiki/Chicxulub_crater
1980, Jun 6	L.W. Alvarez, W. Alvarez, F. Asaro, H.V. Michel, 1980, <i>Science</i> , 208, 1095, 6 June 1980, "Extraterrestrial cause for the Cretaceous–Tertiary [K-T] extinction." See: http://adsabs.harvard.edu/abs/1980Sci...208.1095A
1980, Aug 5	Tajikistan Fireball , 5 August 1980, observed by the meteor observing stations operated by the Meteor Patrol of the Hissar Astronomical Observatory (Tajikistan) and Kipchak station. Ref: - N.A. Konovalova, J.M. Madiedo, J.M. Trigo-Rodríguez, 2013, LPI Contribution No. 1719, p. 1479, "Analysis of a large meteorite-dropping fireball from the Apollo NEA family." See: http://adsabs.harvard.edu/abs/2013LPICo1719.1479K
1980, Sep 22	Apollo NEA 2016 FW3 ($H = 25.5$ mag, $D \approx 29$ m) passed Earth at a nominal miss distance of 1.01 LD. Minimum miss distance 1.003 LD. See: 2016 FW3 - JPL , 2016 FW3 - SSA
1980, Sep 28	Aten NEA 2011 TO ($H = 26.3$ mag, $D \approx 23$ m) passed Earth at a nominal miss distance of 9.34 LD. Minimum miss distance 0.79 LD. See: 2011 TO - JPL , 2011 TO - SSA See also: 28 Sep 2011 , 27 Sep 2044 .
1980, Oct 15	Aten NEA 2018 RY1 ($H = 24.4$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [1980-01] See: 2018 RY1 - JPL , 2018 RY1 - SSA
1981 , Feb 13	D.V. Kent, G.C. Reid, R.E. Brown, L.W. Alvarez, et al. 1981, <i>Science</i> , 211, 648, 13 February 1981, "Asteroid extinction hypothesis." See: http://adsabs.harvard.edu/abs/1981Sci...211..648K
1981, May 7	R.A.F. Grieve, 1981, <i>Nature</i> , 291, 16, "Impact cratering." See: http://adsabs.harvard.edu/abs/1981Natur.291...16G
1981, May 18	Apollo NEA 143651 (2003 QO104 , $H = 16.2$ mag, $D \approx 2290$ m, PHA) passed Earth at a nominal miss distance of 2.76 LD. Minimum miss distance 2.76 LD. See: 2003 QO104 - JPL , 143651 2003 QO104 - SSA See also: https://en.wikipedia.org/wiki/(143651)_2003_QO104

1981, Jul 2	J. Smit, G. Klaver, 1981, <i>Nature</i> , 292, 47, 2 July 1981, "Sanadine spherules at the Cretaceous-Tertiary boundary indicate a large impact event." See: http://www.nature.com/nature/journal/v292/n5818/abs/292047a0.html http://adsabs.harvard.edu/abs/1981Natur.292...47S
1981, Jul 13-16	<i>First NASA NEO workshop on Collision of Asteroids and Comets with the Earth: Physical and Human Consequences</i> , Snowmass (CO, USA), chaired by Eugene M. Shoemaker. Report never published. Ref: - D. Chandler, 2008, <i>Nature</i> , 453, 1164, "The burger bar that saved the world." See: http://www.nature.com/news/2008/080625/full/4531164a.html
1981, Oct 2	R.P. Turco, O.B. Toon, C. Park, et al., 2 October 1981, <i>Science</i> , 214, 19, " Tunguska meteor fall of 1908 – effects on stratospheric ozone." See: http://adsabs.harvard.edu/abs/1981Sci...214...19T
1981, Oct 12-22	<i>First Snowbird Conference on Large Body Impacts and Terrestrial Evolution: Geological, Climatological, and Biological Implications</i> , Snowbird (Utah, USA). See: http://www.lpi.usra.edu/lpi_40th/1981.shtml
1981, Nov	C. Emiliani, E.B. Kraus, E.M. Shoemaker, 1981, <i>Earth and Planetary Science Letters</i> , 55, 317, "Sudden death at the end of Mesozoic." See: http://adsabs.harvard.edu/abs/1981E%26PSL..55..317E
1981, Nov	G.W. Wetherill, 1981, <i>Icarus</i> , 48, 308, "Which fireballs are meteorites – a study of the Prairie Network photographic meteor data." See: http://adsabs.harvard.edu/abs/1981Icar...48..308W
1982	L.T. Silver, P.H. Schulz (eds.), 1982, Proc., <i>Geological implications of impacts of large asteroids and comets on the Earth</i> , Geological Society of America Special Papers, Vol. 190. See: http://specialpapers.gsapubs.org/content/190
1982, Jan 8	Aten NEA 2020 AD3 ($H = 21.6$ mag, $D \approx 170$ m, PHA) passed Earth at a nominal miss distance of 8.47 LD. Minimum miss distance 8.47 LD. See: 2020 AD3 – S2P , 2020 AD3 - JPL See also: 12 Jan 2132 .

1982, Jan 9	Aten NEA 2018 AM12 ($H = 20.9$ mag, $D \approx 230$ m, PHA) passed Earth at a nominal miss distance of 2.57 LD. Minimum miss distance 2.56 LD. See: 2018 AM12 - JPL , 2018 AM12 - SSA See also: 11 Jan 2191 .
1982, Jan 30	Apollo NEA 292220 (2006 SU49 , $H = 19.7$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 4.49 LD. Minimum miss distance 4.49 LD. See: 2006 SU49 - JPL , 2006 SU49 - SSA https://en.wikipedia.org/wiki/(292220)_2006_SU49 See also: 29 Jan 1977 , 28 Jan 2029 .
1982, Feb 8	Aten NEA 2021 CS9 ($H = 24.3$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 1.73 LD. Minimum miss distance 0.43 LD. See: 2021 CS9 – S2P , 2021 CS9 - JPL
1982, Oct 21	Apollo NEA 171576 (1999 VP11 , $H = 18.7$ mag, $D \approx 700$ m, PHA) passed Earth at a nominal miss distance of 2.77 LD. Minimum miss distance 2.77 LD. See: 1999 VP11 - JPL , 1999 VP11 - SSA See also: 21 Oct 1965 , 22 Oct 2086 .
1982, Nov 4	Apollo NEA 2012 TY52 ($H = 21.3$ mag, $D \approx 190$ m, PHA) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.81 LD. [1982-01] See: 2012 TY52 - JPL , 2012 TY52 - SSA See also: 6 Nov 2158 .
1982, Nov 8	The Wethersfield Fireball and Meteorite . See: http://peabody.yale.edu/collections/meteorites-and-planetary-science/wethersfield-meteorite
1982, Nov 28	Apollo NEA 2018 WG2 ($H = 30.2$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 2.905 LD. Minimum miss distance 0.011 LD (= 0.65 R_{Earth} from the geocenter) . See: 2018 WG2 - SSA , 2018 WG2 - JPL See also: 30 Nov 2018 .
1983	E.M. Shoemaker, 1983, <i>Annual Review of Earth and Planetary Science</i> , 11, 461, "Asteroid and comet bombardment of the Earth." See: http://adsabs.harvard.edu/abs/1983AREPS..11..461S
1983	Discovery of the Chesapeake Bay impact crater , formed by a bolide that impacted the eastern shore of North America ~35 million years ago. It is the largest impact crater in the USA. Ref:

	- Wuchang Wei, C.W. Poag, L.J. Poppe, et al., 1993, <i>Geology</i>, 21, 478, "Deep sea drilling Project Site 612 bolide event: new evidence of a late Eocene impact-wave deposit and a possible impact site, U.S. east coast: comment and reply." See: http://geology.geoscienceworld.org/cgi/content/abstract/21/5/478> - C. Koeberl, W.U. Reimold, D. Brandt, C.W. Poag, 1995, <i>Meteoritics</i>, 30, 528, "Chesapeake Bay crater, Virginia: confirmation of impact origin." See: http://adsabs.harvard.edu/abs/1995Metic..30R.528K See also: http://woodshole.er.usgs.gov/epubs/bolide/ http://en.wikipedia.org/wiki/Chesapeake_Bay_impact_crater
1983, Jan 3	Apollo NEA 471240 (2011 BT15, $H = 21.7$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 4.04 LD. Minimum miss distance 4.04 LD. See: 2011 BT15 - JPL , 2011 BT15 - SSA See also: 7 Jan 2102.
1983, Mar 19	Apollo NEA 2018 VG3 ($H = 21.0$ mag, $D \approx 230$ m, PHA) passed Earth at a nominal miss distance of 1.55 LD. Minimum miss distance 1.51 LD. See: 2018 VG3 - JPL , 2018 VG3 - SSA
1983, Mar 20	Apollo NEA 2021 FO1 ($H = 29.5$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 6.88 LD. Minimum miss distance 0.25 LD. See: 2021 FO1 – S2P , 2021 FO1 – JPL See also: 23 Mar 2021.
1983, Apr 17	Apollo NEA 2019 GC6 ($H = 26.5$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 1.68 LD. Minimum miss distance 0.58 LD. See: 2019 GC6 - SSA , 2019 GC6 - JPL See also: 18 Apr 2019, 17 Apr 2134.
1983, Jun 20-22	<i>International conference on Asteroids, Comets, Meteors</i>, Uppsala (Sweden). Proceedings: C.-I. Lagerkvist & H. Rickman, 1983, <i>Asteroids, Comets, Meteors</i> (Uppsala: Astronomiska Observatoriet). See: http://adsabs.harvard.edu/abs/1983acmp.book.....L
1983, Jul 13	Apollo NEA 2018 NM ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 3.57 LD. Minimum miss distance 0.80 LD. See: 2018 NM - JPL , 2018 NM - SSA
1983, Jul 29	Aten NEA 2021 OC1 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 5.46 LD. Minimum miss distance 0.24 LD. See: 2021 OD1 – S2P , 2021 OD1 - JPL See also: 26 Jul 2034, 27 Jul 2062.

1983, Oct 11	Apollo NEA 3200 Phaethon (1983 TB, $H = 13.9$ mag, $D \approx 5100 \pm 200$ m, PHA) discovered by IRAS. It approaches the Sun closer than any other numbered asteroid: its perihelion is 0.14 AU, i.e., less than half Mercury's perihelion distance. Phaethon is possibly an old comet core. Its closest approach to Earth within the next 190 yr will occur on 14 December 2093 at 7.7 LD. See: 1983 TB - JPL , 3200 Phaethon - SSA Ref: - J. Davies, S.F. Gree, C.M. Bardwell, et al., 1983, <i>IAU Circular</i> 3860, "Comet IRAS (1983o)." See: http://cepsar.open.ac.uk/pers/s.f.green/p4_6.shtml - J. Licandro, H. Campins, T. Mothé-Diniz, et al., 2007, <i>Astronomy & Astrophysics</i>, 461, 751, "The nature of comet-asteroid transition object (3200) Phaethon." See: http://adsabs.harvard.edu/abs/2007A%26A...461..751L - J. de León, H. Campins, K. Tsiganis, et al., 2010, <i>Astronomy & Astrophysics</i>, 513, 26, "Origin of the near-Earth asteroid Phaethon and the Geminids meteor shower." See: http://adsabs.harvard.edu/abs/2010A%26A...513A..26D - D. Jewitt, J. Li, 2010, <i>Astronomical Journal</i>, 140, 1519, "Activity in Geminid parent (3200) Phaethon." See: http://adsabs.harvard.edu/abs/2010AJ....140.1519J - J. Li, D. Jewitt, June 2013, <i>Astronomical Journal</i>, 145, 9, "Recurrent perihelion activity in (3200) Phaethon." See: http://adsabs.harvard.edu/abs/2013AJ....145..154L See also: http://www.cfa.harvard.edu/iauc/03800/03878.html http://en.wikipedia.org/wiki/Geminids http://science.nasa.gov/science-news/science-at-nasa/2010/06dec_geminids/ http://en.wikipedia.org/wiki/3200_Phaethon
1984	The 0.9-m Spacewatch Telescope became the first telescope to detect and discover asteroids and comets with electronic detectors (CCDs, as opposed to photographic plates or films). See: http://spacewatch.lpl.arizona.edu/
1984, Jan	Z. Sekanina, D.K. Yeomans, 1984, <i>Astronomical Journal</i>, 89, 154, "Close encounters and collisions of comets with the Earth." See: http://adsabs.harvard.edu/abs/1984AJ....89..154S
1984, Jan 10	Apollo NEA 2016 TB57 ($H = 26.2$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.77 LD. Minimum miss distance 0.76 LD. [1984-01] See: 2016 TB57 - JPL , 2016 TB57 - SSA

1984, May 24	J.K. Davies, S.F. Green, B.C. Stewart, et al., 1984, <i>Nature</i> , 309, 315, "The IRAS fast-moving object search." See: http://adsabs.harvard.edu/abs/1984Natur.309..315D
1984, Jul	C.J. van Houten, P. Herget, B.G. Marsden, 1984, <i>Icarus</i> , 59, 1, " The Palomar-Leiden Survey of Faint Minor Planets – conclusion." See: http://adsabs.harvard.edu/abs/1984Icar...59....1V
1984, Jul 27	Apollo NEA 2014 SP142 ($H = 21.8$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 2.53 LD. Minimum miss distance 2.49 LD. See: 2014 SP142 - JPL , 2014 SP142- SSA See also: 27 Jul 1930 ,
1984, Aug 2	R.A.F. Grieve, 1984, <i>Nature</i> , 310, 370, "Cretaceous-Tertiary extinctions: physical evidence of impact." See: http://adsabs.harvard.edu/abs/1984Natur.310..370G
1984, Aug	H.J. Melosh, 1984, <i>Icarus</i> , 59, 234, "Impact ejection, spallation, and the origin of meteorites." See: http://adsabs.harvard.edu/abs/1984Icar...59..234M
1984, Oct 18	P. Hut, 1984, <i>Nature</i> , 311, 638, "How stable is an astronomical clock that can trigger mass extinctions on Earth?" See: http://adsabs.harvard.edu/abs/1984Natur.311..638H
1985	Fred L. Whipple (1906 – 2004, USA): " <i>Protection of the Earth from undesirable impacting bodies is not just a science fiction project for some improbable future. The cost might be comparable to, even smaller than, the world's current military expenditures. We could choose to do it now. We could choose to protect ourselves from asteroids and comets rather than from each other.</i> " Ref: F.L. Whipple, 1985, <i>The Mystery of Comets</i> (Baltimore: Smithsonian Institution Press).
1985, Jan 11	Aten NEA 2018 XQ2 ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 7.63 LD. Minimum miss distance 0.016 LD (= 0.97 R_{Earth} from the geocenter). See: 2018 XQ2 - JPL , 2018 XQ2 - SSA
1985, Jan 18	Apollo NEA 85640 (1998 OX4) , $H = 2.9$ mag, $D \approx 230$ m, PHA) passed Earth at a nominal miss distance of 2.52 LD. Minimum miss distance 2.52 LD. See: 1998 OX4 - JPL , 1998 OX4 - SSA See also: 22 Jan 2148 .

1985, Feb	D.I. Steel, W.J. Baggaley, 1985, <i>Monthly Notices Royal Astronomical Society</i> , 212, 817, "Collisions in the Solar System. I. Impacts of the Apollo-Amor-Aten asteroids upon the terrestrial planets." See: http://adsabs.harvard.edu/abs/1985MNRAS.212..817S
1985, Feb 11	Apollo NEA 2012 PB20 ($H = 25.0$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 1.22 LD. Minimum miss distance 0.86 LD. See: 2012 PB20 - JPL , 2012 PB20 - SSA
1985, Mar	G. Hahn, H. Rickman, 1985, <i>Icarus</i> , 61, 417, "Asteroids in cometary orbits." See: http://adsabs.harvard.edu/abs/1985Icar...61..417H
1985, Mar	G.W. Wetherill, 1985, <i>Meteoritics</i> , vol. 20,1, "Asteroidal source of ordinary chondrites." See: http://adsabs.harvard.edu/abs/1985Metic..20....1W
1985, Apr 9	Apollo NEA 2017 UK1 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 1.34 LD. Minimum miss distance 0.51 LD. See: 2017 UK1 - JPL , 2017 UK1- SSA
1985, May 4	Apollo NEA 394130 (2006 HY51 , $H = 17.2$ mag, $D = 1218 \pm 228$ m) passed Earth at a nominal miss distance of 42.32 LD. Minimum miss distance 42.32 LD. See: 2006 HY 51 – SSA , 2006 HY51 – JPL See also : 4 May 1939 . See also : https://en.wikipedia.org/wiki/(394130)_2006_HY51 Eccentricity: 0.9695. Mercury, Venus, Earth, Mars, Jupiter crosser. 0.9
1985, May 17	G.W. Wetherill, 1985, <i>Science</i> , 228, 877, "Occurrence of giant impacts during the growth of the terrestrial planets." See: http://adsabs.harvard.edu/abs/1985Sci...228..877W
1985, Jun	P. Hut, P.R. Weissman, 1985, <i>Bulletin of the American Astronomical Society</i> , 17, 690, "Double craters on the Earth and planets: evidence for binary asteroids and comets." See: http://adsabs.harvard.edu/abs/1985BAAS...17R.690H
1985, Jun 3-6	<i>International conference on Asteroids, Comets, Meteors, II</i> , Uppsala (Sweden). Proceedings: C.-I. Lagerkvist, H. Rickman, B.A. Lindblad, H. Lundstedt, 1986, <i>Asteroids, Comets, Meteors II</i> (Uppsala: Astronomiska Observatoriet). See: http://adsabs.harvard.edu/abs/1986acm..proc.....L
1985, Jul 12	L.A. McFadden, M.J. Gaffey, Th.B. Mccord, 1985, <i>Science</i> , 229, 160,

	"Near-Earth Asteroids: possible sources from reflectance spectroscopy." See: http://adsabs.harvard.edu/abs/1985Sci...229..160M
1985, Jul 31	Aten NEA 2021 OD1 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.32 LD. [1985-01] See: 2021 OD1 – S2P , 2021 OD1 - JPL See also: 31 Jul 2021, 1 Aug 2066.
1985, Sep 2	Apollo NEA 371660 (2007 CN26, $H = 20.9$ mag, $D \approx 240$ m, PHA) passed Earth at a nominal miss distance of 1.05 LD. Minimum miss distance 1.05 LD. See: 2007 CN26 - JPL , 371660 2007 CN26 - SSA
1985, Oct	P. Hut, 1985, <i>Zenit</i>, 12, 308, "Dreiging uit de kosmos." See: http://adsabs.harvard.edu/abs/1985Zenit..12..308H
1985, Nov 28	I. Halliday, A.T. Blackwell, A.A. Griffin, 28 November 1985, <i>Nature</i>, 318, 317, "Meteorite impacts on humans and buildings." See: http://www.nature.com/nature/journal/v318/n6044/abs/318317a0.html
1985, Dec	S.F. Green, N. Eaton, A.J. Meadows, J.K. Davies, B.C. Stewart, 1985, <i>Icarus</i>, 64, 517, "The detection of fast-moving asteroids and comets by IRAS." See: http://adsabs.harvard.edu/abs/1985Icar...64..517G
1985, Dec	R.A.F. Grieve, V.L. Sharpton, A.K. Goodacre, 1985, <i>Earth and Planetary Science Letters</i>, 76, 1, "A perspective on the evidence for periodic cometary impacts on Earth." See: http://adsabs.harvard.edu/abs/1985E%26PSL..76....1G
1986	D.L. Matson, 1986, <i>The IRAS Asteroid and Comet Survey</i>, JPL D-3689 (Pasadena: JPL). See: http://irsa.ipac.caltech.edu/IRASdocs/surveys/comet.html
1986, Jan	D.I. Steel, W.G. Elford, 1986, <i>Monthly Notices Royal Astronomical Society</i>, 218, 185, "Collisions in the Solar System. III. Meteoroid survival times." See: http://adsabs.harvard.edu/abs/1986MNRAS.218..185S
1986, Jan 29	Apollo NEA 2020 OP3 ($H = 20.8$ mag, $D \approx 230$ m, PHA) passed Earth at a nominal miss distance of 4.82 LD. Minimum miss distance 4.77 LD. See: 2020 OP3 – S2P , 2020 OP3 - JPL See also: 28 Jan 2027, 29 Jan 2046.

1986, Mar 13	ESA spacecraft Giotto flyby of comet Halley. Ref: - J. Kissel, D.E. Brownlee, K. Buchler, et al., 1986, <i>Nature</i>, 321, 336, "Composition of comet Halley dust particles from Giotto observations." See: http://adsabs.harvard.edu/abs/1986Natur.321..336K - G. Schwehm, 2006, <i>ESA Bulletin</i>, 125, 8, "Twenty years after Giotto - ESA's pioneering mission to comet Halley." See: http://adsabs.harvard.edu/abs/2006ESABu.125....8S See also: http://hubble.esa.int/science-e/www/object/index.cfm?fobjectid=31876 http://hubble.esa.int/science-e/www/area/index.cfm?fareaid=15 http://www.esa.int/SPECIALS/Rosetta/SEMMA0YTVKG_0.html http://www.esa.int/esaSC/SEMUAJ4LOG_index_0.html http://www.esa.int/esaSC/SEM18PD1XOG_index_0.html
1986, Apr 30	Apollo NEA 2019 JD6 ($H = 25.0$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 5.83 LD. Minimum miss distance 0.78 LD. See: 2019 JD6 – SSA , 2019 JD6 - JPL
1986, Sep 22-25	R.N. Pugh, J.E. Allen, 1986, presented at the <i>49th Annual Meeting of the Meteoritical Society</i>, American Museum of Natural History, New York (NY, USA), LPI Contribution 600, p.208, "Origing of the Willamette Meteorite." See: http://adsabs.harvard.edu/abs/1986LPICo.600E.208P http://en.wikipedia.org/wiki/Willamette_Meteorite
1986, Oct 11	Apollo NEA 2012 TC4 ($H = 26.7$ mag, $D \approx 15 \times 8$ m) passed Earth at a nominal miss distance of 3.09 LD. Minimum miss distance 0.000052 LD (= 0.0031 R_{Earth} from the geocenter). See: 2012 TC4 - JPL , 2012 TC4 - SSA See also: 12 Oct 2012, 12 Oct 2017
1987	R.A.F. Grieve, 1987, <i>Annual Reviews of Earth and Planetary Sciences</i>, 15, 245, "Terrestrial impact structures." See: http://adsabs.harvard.edu/abs/1987AREPS..15..245G
1987, Apr 21	Apollo NEA 2017 HV2 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 9.75 LD. Minimum miss distance 0.21 LD. See: 2017 HV2 - JPL , 2017 HV2 - SSA
1987, Jun 1	Apollo NEA 2014 WG365 ($H = 20.1$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 4.94 LD. Minimum miss distance 4.94 LD. See: 2014 WG365 - JPL , 2014 WG365 - SSA

1987, Jun 27	Apollo NEA 2019 MO ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 3.40 LD. Minimum miss distance 1.0003 LD. See: 2019 MO - JPL , 2019 MO - SSA See also: 22 June 2019, object impacted Earth.
1987, Jul	D.K. Yeomans, S.J. Ostro, P.W. Chodas, 1987, <i>Astronomical Journal</i> , 94, 189, "Radar astrometry of near-earth asteroids." See: http://adsabs.harvard.edu/abs/1987AJ.....94..189Y
1987, Jul	Z. Ceplecha, P. Spurný, J. Bocek, et al., 1987, <i>Bulletin Astronomical Institutes of Czechoslovakia</i> , 38, 211, " European Network fireballs photographed in 1978." See: http://adsabs.harvard.edu/abs/1987BAICz..38..211C
1987, Jul	Z. Ceplecha, 1987, <i>Bulletin of the Astronomical Institutes of Czechoslovakia</i> , 38, 222, "Geometric, dynamic, orbital and photometric data on meteoroids from photographic fireball networks ." See: http://adsabs.harvard.edu/abs/1987BAICz..38..222C
1987, Sep	P. Hut, W. Alvarez, W.P. Elder, et al., 1987, <i>Nature</i> , 329, 118, "Comet showers as a cause of mass extinction." See: http://adsabs.harvard.edu/abs/1987Natur.329..118H
1987, Nov 3	Apollo NEA 2010 TU149 ($H = 21.0$ mag, $D \approx 603$ m, PHA) passed Earth at a nominal miss distance of 4.75 LD. Minimum miss distance 4.74 LD. See: 2010 TU149 - JPL , 2010 TU149 - SSA
1988	T. Gehrels, 1988, <i>On the Glassy Sea. An Astronomer's Journey</i> (New York: American Institute of Physics), Ch. 16, p. 183, "Asteroid I mpacts and planet formation". Including the history of the 90 cm Spacewatch Telescope on Kitt Peak (AZ, USA). See: http://adsabs.harvard.edu/abs/1988gsaa.book.....G
1988, Jan 27	Apollo NEA 2008 TC3 ($H = 30.3$ mag, $D \approx 4.1$ m) passed Earth at a nominal miss distance of 11.22 LD. Minimum miss distance 10.82 LD. See: 2008 TC3 - JPL , 2008 TC3 - SSA See also: 4 Oct 1917, 11 Oct 1961, 2 Oct 1971, 6 Oct 2008.
1988, Feb 18	K.A. Maher, D.J. Stevenson, 1988, <i>Nature</i> , 331, 612, "Impact frustration of the origin of life." See: http://adsabs.harvard.edu/abs/1988Natur.331..612M

1988, Mar 8-11	<i>International conference on Asteroids II</i> , Tucson (AZ, USA). Proceedings: R.P. Binzel, T. Gehrels, & M.S. Matthews (eds.), 1989, <i>Asteroids II</i> (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/1989aste.conf.....B
1988, Apr 21	H.J. Melosh, 1988, <i>Nature</i> , 332, 687, "The rocky road to panspermia." See: http://adsabs.harvard.edu/abs/1988Natur.332..687M
1988, Jul	Z. Ceplecha, 1988, <i>Bulletin Astronomical Institutes of Czechoslovakia</i> , 39, 221, "Earth's influx of different populations of sporadic meteoroids from photographic and television data." See: http://adsabs.harvard.edu/abs/1988BAICz..39..221C
1988, Aug	T. Gehrels, 1988, in: <i>Reports of Planetary Astronomy</i> (NASA: Washington), p. 45, "CCD scanning for comets and asteroids." See: http://adsabs.harvard.edu/abs/1988plas.rept...45G
1988, Sep 22	Apollo NEA 523654 (2011 SR5 , $H = 20.5$ mag, $D \approx 280$ m, PHA) passed Earth at a nominal miss distance of 4.78 LD. Minimum miss distance 4.77 LD. See: 2011 SR5 - JPL , 2011 SR5 - SSA See also: 23 Sep 2066 .
1988, Sep 29	Apollo NEA 360191 (1988 TA , $H = 20.0$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 3.83 LD. Minimum miss distance 3.83 LD. See: 1988 TA - JPL , 1988 TA - SSA See also: 20 Sep 2053 , 3 Oct 2189 .
1988, Oct	G.W. Wetherill, 1988, <i>Icarus</i> , 76, 1, "Where do the Apollo objects come from?" See: http://adsabs.harvard.edu/abs/1988Icar...76....1W
1988, Oct 15	Aten NEA 2010 UK ($H = 27.1$ mag, $D \approx 13$ m) passed Earth at at a nominal miss distance of 0.96 LD. Minimum miss distance 0.82 LD. [1988-01] See: 2010 UK - JPL , 2010 UK - SSA
1988, Oct 20-22	<i>Second Snowbird Conference on Global Catastrophes in Earth History: Interdisciplinary Conference on Impacts, Volcanism, and Mass Mortality</i> , Snowbird (Utah, USA). Proc.: V.L. Sharpton & P.D. Ward (eds.), 1991, <i>Geol. Soc. of America Special Paper</i> , Vol. 247. See: http://www.lpi.usra.edu/lpi_40th/1988.shtml

1988, Oct 22	E.M. Shoemaker, C.S. Shoemaker, R.F. Wolfe, 1988, in: V.L. Sharpton & P.D. Ward (eds.), 1991, Proc. Second Snowbird Conference on <i>Global Catastrophes in Earth History: Interdisciplinary Conference on Impacts, Volcanism, and Mass Mortality</i> , Snowbird (Utah, USA), "Asteroid and comet flux in the neighbourhood of the Earth." See: http://www.lpi.usra.edu/lpi_40th/1988.shtml
1989	T. Gehrels begins full NEO search operation using CCD drift-scan mode at the Spacewatch Telescope , on Kitt Peak (AZ, USA). See: http://spacewatch.lpl.arizona.edu/
1989	C.R. Chapman, D. Morrison, 1989, <i>Cosmic Catastrophes</i> (New York: Plenum). See: http://adsabs.harvard.edu/abs/1989coca.book.....C
1989	H.J. Melosh, 1989, <i>Impact cratering: a geologic process</i> (New York: Oxford University Press). See: http://adsabs.harvard.edu/abs/1989icgp.book.....M http://adsabs.harvard.edu/abs/1989S%26T....78T.382M
1989	D.L. Matson, G.J. Veeder, E.F. Tedesco, L.A. Lebofsky, 1989, in: <i>Asteroids II</i> , R.P. Binzel, et al. (eds.), Proc. Conf. in Tucson (AZ, USA) 8-11 March 1988, (Univ. Arizona Press), p. 269, "The IRAS asteroid and comet survey". See: http://adsabs.harvard.edu/abs/1989aste.conf..269M A total of 1811 asteroids and 25 comets with known orbits were measured. Evidence was found in the IRAS data base for a large population of asteroids with unknown orbits. See also: D.L. Matson, IPAC, JPL D-3698, 1986, http://irsa.ipac.caltech.edu/IRASdocs/surveys/comet.html
1989	C.M. Bardwell (1926 – 2010), 1989, <i>Temmon Guide Marsden</i> , "A brief history of the Minor Planet Center ." See: http://www.oaa.gr.jp/~oaacs/mp/BriefHistoryofMPCbyConradBardwell.pdf
1989, Jan 4	Re-discovery of the largest known PHA: 4179 Toutatis, 1989 AC ($H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, $P = 4.03$ yr). It was first sighted on February 10, 1934, as object 1934 CT , and then promptly lost. Re-discovery on January 4, 1989, by Christian Pollas (France), and was named after the Celtic god Toutatis/Teutates, known to popular culture as the God the cartoon character Astérix's chief Vitalstatistix evokes so that the sky may never fall on his head. Radar imagery has shown

	that Toutatis is a irregular body consisting of two distinct "lobes", with maximum widths of about 4.6 km and 2.4 km respectively. It is hypothesized that Toutatis formed from two originally separate bodies which coalesced at some point, with the resultant asteroid being compared to a "rubble pile". See: 1989 AC - JPL , 4179 Toutatis - SSA Ref: - J.-L. Heudier, R. Chemin, A. Maury, C. Pollas, January 1989, <i>IAU Circ.</i>, 4701, 2, "1989 AC." See: http://adsabs.harvard.edu/abs/1989IAUC.4701....2H - S.J. Ostro, R.S. Hudson, R.F. Jurgens, et al., 1995, <i>Science</i>, 270, 80, "Radar images of asteroid 4179 Toutatis." See: http://adsabs.harvard.edu/abs/1995Sci...270...80O - R.S. Hudson, S.J. Ostro, 1995, <i>Science</i>, 270, 84, "Shape and non-principal axis spin state of asteroid 4179 Toutatis." See: http://adsabs.harvard.edu/abs/1995Sci...270...84H - D.J. Scheeres, S.J. Ostro, R.S. Hudson, et al., 1998, <i>Icarus</i>, 132, 53, "Dynamics of orbits close to asteroid 4179 Toutatis." See: http://adsabs.harvard.edu/abs/1998Icar..132...53S - S.J. Ostro, R.S. Hudson, K.D. Rosema, et al., 1999, <i>Icarus</i>, 137, 122, "Asteroid 4179 Toutatis: 1996 radar observations." See: http://adsabs.harvard.edu/abs/1999Icar..137..122O - R.S. Hudson, S.J. Ostro, D.J. Scheeres, 2003, <i>Icarus</i>, 161, 346, "High-resolution model of asteroid 4179 Toutatis." See: http://adsabs.harvard.edu/abs/2003Icar..161..346H - A.M. MacRobert, 2004, <i>Sky & Telescope</i>, 108 (3), 82, "The Closest Whiz-by of Toutatis." See: http://adsabs.harvard.edu/abs/2004S%26T...108c..82M http://br.groups.yahoo.com/group/Astronomynews/message/5177 See also: http://science.nasa.gov/science-news/science-at-nasa/2000/ast31oct_1/ http://en.wikipedia.org/wiki/Toutatis-4179
1989, Mar	G.W. Wetherill, 1989, <i>Meteoritics</i>, 24, 15, "Cratering of the terrestrial planets by Apollo objects." See: http://adsabs.harvard.edu/abs/1989Metic..24...15W
1989, Mar 22	Apollo NEA 4581 Asclepius (1989 FC, $H = 20.9$ mag, $D \approx 230$ m, PHA) passed Earth at at a nominal miss distance of 1.78 LD. Minimum miss distance 1.78 LD. The next pass to come within 3 LD will not take place until 2189. See: 1989 FC - JPL , 4581 Asclepius - SSA Ref: - C.R. Chapman, D. Morrison, E. Bowell, 1989, in: <i>52nd Annual Meeting of the Meteoritical Society</i>, 31 July 31 – 4 August, Vienna

	(Austria), LPI Contr. 712, <i>Meteoritics</i>, 24, 258, "Hazards from Earth-approachers: implications of 1989 FC's 'Near Miss'." See also: http://adsabs.harvard.edu/abs/1989LPICo.712...33C http://adsabs.harvard.edu/abs/1989Metic..24S.258C http://en.wikipedia.org/wiki/4581_Asclepius See also: 16 Aug 2012, 24 Mar 2051.
1989, Apr	G. Hahn, P. Magnusson, A.W. Harris, et al., 1989, <i>Icarus</i>, 78, 363, "Physical studies of Apollo-Amor asteroids - <i>UBVRI</i> photometry of 1036 Ganymed and 1627 Ivar." See: http://adsabs.harvard.edu/abs/1989Icar...78..363H
1989, Apr	A. Milani, M. Carpino, G. Hahn, A.M. Nobili, 1989, <i>Icarus</i>, 78, 212, "Dynamics of planet-crossing asteroids – classes of orbital behaviour. Project SPACEGUARD." See: http://adsabs.harvard.edu/abs/1989Icar...78..212M
1989, Apr	G.J. Veeder, M.S. Hanner, D.L. Matson, et al., 1989, <i>Astronomical Journal</i>, 97, 1211, "Radiometry of Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/1989AJ.....97.1211V
1989, May	S. van den Bergh, 1989, <i>Publ. Astron. Soc. Pacific</i>, 101, 500, "Life and death in the inner solar system." See: http://adsabs.harvard.edu/abs/1989PASP..101..500V http://www.astronomynotes.com/solfluf/s5.htm
1989, Jun 6	Apollo NEA 2018 LA ($H = 30.5$ mag, $D \approx 2.8$ m) passed Earth at a nominal miss distance of 18.80 LD. Minimum miss distance 0.24 LD.. See: 2018 LA - SSA , 2018 LA - JPL See also: 2 June 2018.
1989, Jun 12-16	<i>International conference on Asteroids, Comets, Meteors, III</i>, Uppsala (Sweden). Proceedings: C.-I. Lagerkvist, H. Rickman, B.A. Lindblad, & M. Lindgren, 1990, <i>Asteroids, Comets, Meteors III</i> (Uppsala: Astronomiska Observatoriet). See: http://adsabs.harvard.edu/abs/1990acmi.book.....L
1989, Jul 28	Apollo NEA 2020 OY4 ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 5.14 LD. Minimum miss distance 0.36 LD. See: 2020 OY4 – S2P , 2020 OY4 - JPL See also: 28 Jul 2020.
1989, Aug 19-22	First-ever radar images of an asteroid: 4769 Castalia (1989 PB, Apollo NEA, $H = 17.8$ mag, $D = 1.8 \times 0.8$ km, PHA) obtained with

	the 305 m Arecibo radio telescope by Steven J. Ostro (1946 – 2008) of NASA JPL, Pasadena (CA, USA) and R. Scott Hudson of Caltech, Pasadena. At the time of observation the distance to 4769 Castalia was $d = 11$ LD. See: 1989 PB - JPL , 4769 Castalia - SSA See also: http://en.wikipedia.org/wiki/4769_Castalia Ref: - S.J. Ostro, J.F. Chandler, A.A. Hine, et al., 1990, <i>Science</i>, 248, 1523, "Radar images of asteroid 1989 PB." See: http://adsabs.harvard.edu/abs/1990Sci...248.1523O As of May 2008, Ostro and his collaborators had detected 222 NEAs (including 130 PHAs and 24 binaries) and 118 main-belt objects with radar.
1989, Sep 15	Apollo NEA 408792 (2000 GF2), $H = 20.6$ mag, $D \approx 270$ m, PHA) passed Earth at a nominal miss distance of 4.90 LD. Minimum miss distance 4.90 LD. See: 2000 GF2- JPL , 2000 GF2- SSA
1989, Nov	J. Luu, D. Jewitt, 1989, <i>Astronomical Journal</i>, 98, 1905, "On the relative numbers of C types and S types among near-earth asteroids." See: http://adsabs.harvard.edu/abs/1989AJ.....98.1905L
1989, Nov 4	Apollo NEA 2015 JJ ($H = 22.3$ mag, $D \approx 130$ m) passed Earth at a nominal miss distance of 9.12 LD. Minimum miss distance 9.12 LD. See : 2015 JJ - JPL , 2015 JJ - SSA See also: 5 Nov 2050, 5 Nov 2094, 6 Nov 2110,
1989, Nov 6	D.M. Raup, P.A. Sabine, P. Ashmole, et al., 1989, <i>Philosophical Transactions of the Royal Society of London</i>, series B, Biological Sciences, vol. 325, No. 1228, Evolution and Extinction, p. 421, "The case for extraterrestrial causes of extinction." See: http://adsabs.harvard.edu/abs/1989RSPTB.325..421R http://www.jstor.org/stable/pdfplus/2396933.pdf?acceptTC=true
1989, Nov 9	N.H. Sleep, K.J. Zahnle, J.F. Kasting, H.J. Morowitz, 1989, <i>Nature</i>, 342, 139, "Annihilation of ecosystems by large asteroid impacts on the early Earth." See: http://adsabs.harvard.edu/abs/1989Natur.342..139S
1989, Dec	C.R. Chapman, D. Morrison, 1989, <i>Mercury</i>, 18, 185, "Cosmic impacts, cosmic catastrophes." See: http://adsabs.harvard.edu/abs/1989Mercu..18..185C

1990, Jan 1	134 NEAs known, of which 42 PHAs. See: http://neo.jpl.nasa.gov/stats/
1990	V.L. Sharpton, P.D. Ward (eds.), 1990, Proc. <i>Global catastrophes in earth history; an interdisciplinary conference on impacts, volcanism, and mass mortality</i>, ..., ..., 20-23 October 1988, <i>Geological Society of America Special Papers</i>, Vol. 247. See: http://specialpapers.gsapubs.org/content/247 Among the articles: - K.W. Flessa, 1990, <i>GSA SP</i>, 247, 1, "The "facts" of mass extinctions." See: http://specialpapers.gsapubs.org/content/247/1.abstract - R.B. Stothers, M.R. Rampino, 1990, <i>GSA SP</i>, 247, 9, "Periodicity in flood basalts, mass extinctions, and impacts; A statistical view and a model." See: http://specialpapers.gsapubs.org/content/247/9.abstract - D.E. Loper, K.McCartney, 1990, <i>GSA SP</i>, 247, 19, "On impacts as a cause of geomagnetic field reversals or flood basalts." See: http://specialpapers.gsapubs.org/content/247/19.abstract - D.M. Raup, 1990, <i>GSA SP</i>, 247, 27, "Impact as a general cause of extinction; A feasibility test " See: http://specialpapers.gsapubs.org/content/247/27.abstract - C.J. Orth, M. Attrep, L.R. Quintana, 1990, <i>GSA SP</i>, 247, 45, "Iridium abundance patterns across bio-event horizons in the fossil record." See: http://specialpapers.gsapubs.org/content/247/45.abstract - K.J. Hsü, J.A. McKenzie, 1990, <i>GSA SP</i>, 247, 61, "Carbon-isotope anomalies at era boundaries; Global catastrophes and their ultimate cause." See: http://specialpapers.gsapubs.org/content/247/61.abstract - S.A. Davenport, T.J. Wdowiak, D.D. Jones, P.Wdowiak, 1990, <i>GSA SP</i>, 247, 71, "Chondritic metal toxicity as a seed stock kill mechanism in impact-caused mass extinctions." See: http://specialpapers.gsapubs.org/content/247/71.abstract - W. Alvarez, 1990, <i>GSA SP</i>, 247, 93, "Interdisciplinary aspects of research on impacts and mass extinctions; A personal view." See: http://specialpapers.gsapubs.org/content/247/93.abstract - U.B. Marvin, 1990, <i>GSA SP</i>, 247, 147, "Impact and its revolutionary implications for geology." See: http://specialpapers.gsapubs.org/content/247/147.abstract - E.M. Shoemaker, R.F. Wolfe, C.S. Shoemaker, 1990, <i>GSA SP</i>, 247, 1, "Asteroid and comet flux in the neighborhood of Earth." See: http://specialpapers.gsapubs.org/content/247/155.abstract - P.R. Weissman, 1990, <i>GSA SP</i>, 247, 171, "The cometary impactor flux at the Earth." See: http://specialpapers.gsapubs.org/content/247/171.abstract - N.G. Barlow, 1990, <i>GSA SP</i>, 247, 181, "Application of the inner Solar System cratering record to the Earth." See: http://specialpapers.gsapubs.org/content/247/181.abstract

	- R. Rocchia, P. Bonté, C.Jéhanno, et al., 1990, <i>GSA SP</i>, 247, 189, "Search for the Tunguska event relics in the Antarctic snow and new estimation of the cosmic iridium accretion rate." See: http://specialpapers.gsapubs.org/content/247/189.abstract - H.E. Newsom, G. Graup, D.A. Iseri, et al., 1990, <i>GSA SP</i>, 247, 195, "The formation of the Ries Crater, West Germany; Evidence of atmospheric interactions during a larger cratering event." See: http://specialpapers.gsapubs.org/content/247/195.abstract - J.B. Hartung, M.J. Kunk, R.R. Anderson, et al., 1990, <i>GSA SP</i>, 247, 207, "Geology, geophysics, and geochronology of the Manson impact structure." See: http://specialpapers.gsapubs.org/content/247/207.abstract - L.F. Jansa, M--P. Aubry, F.M. Gradstein, 1990, <i>GSA SP</i>, 247, 223, "Comets and extinctions; Cause and effect." See: http://specialpapers.gsapubs.org/content/247/223.abstract - C. Koeberl, V.L. Sharpton, T.M.Harrison, et al., 1990, <i>GSA SP</i>, 247, 233, "The Kara/Ust-Kara twin impact structure; A large-scale impact event in the Late Cretaceous." See: http://specialpapers.gsapubs.org/content/247/233.abstract - P.H. Schultz, D.E. Gault, 1990, <i>GSA SP</i>, 247, 239, "Prolonged global catastrophes from oblique impacts." See: http://specialpapers.gsapubs.org/content/247/239.abstract - C. Covey, S.J. Ghan, J.J. Walton, P.R. Weissman, 1990, <i>GSA SP</i>, 247, 263, "Global environmental effects of impact-generated aerosols; Results from a general circulation model." See: http://specialpapers.gsapubs.org/content/247/263.abstract - K.J. Zahnle, 1990, <i>GSA SP</i>, 247, 271, "Atmospheric chemistry by large impacts." See: http://specialpapers.gsapubs.org/content/247/271.abstract - A.M. Vickery, H.J. Melosh, 1990, <i>GSA SP</i>, 247, 289, "Atmospheric erosion and impactor retention in large impacts, with application to mass extinctions." See: http://specialpapers.gsapubs.org/content/247/289.abstract - V.L. Sharpton, R.A.F. Grieve, 1990, <i>GSA SP</i>, 247, 301, "Meteorite impact, cryptoexplosion, and shock metamorphism; A perspective on the evidence at the K/T boundary." See: http://specialpapers.gsapubs.org/content/247/301.abstract - B.F. Bohor, 1990, <i>GSA SP</i>, 247, 335, "Shocked quartz and more; Impact signatures in Cretaceous/Tertiary boundary clays." See: http://specialpapers.gsapubs.org/content/247/335.abstract - V.L. Sharpton, B.C. Schuraytz, K. Burke, et al., 1990, <i>GSA SP</i>, 247, 349, "Detritus in K/T boundary clays of western North America; Evidence against a single oceanic impact." See: http://specialpapers.gsapubs.org/content/247/349.abstract - E. Doehne, S.V. Margolis, 1990, <i>GSA SP</i>, 247, 367, "Trace-element geochemistry and mineralogy of the Cretaceous/Tertiary boundary; Identification of extraterrestrial components."

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1990	From 1990 until its termination in 1996, Duncan Steel, director of Spaceguard Australia and Vice-President of The Spaceguard Foundation (see 26 March 1996), directed the southern hemisphere program Anglo-Australian Near Earth Asteroid Survey (AANEAS) for the discovery and tracking of near-Earth asteroids, based at the Anglo-Australian Observatory, using the UK 1.2m Schmidt Telescope. Ref: - D.I. Steel, R.H. McNaught, G.J. Garradd, D.J. Asher, K.S. Russell, 1997, <i>Australian J. Astron.</i>, 7, 67, "AANEAS: a valedictory report." See: http://adsabs.harvard.edu/abs/1997AuJA....7...67S http://users.tpg.com.au/users/tps-seti/spacegd4.html http://www.sis-group.org.uk/abstract/steel2.htm http://en.wikipedia.org/wiki/Anglo-Australian_Near-Earth_Asteroid_Survey
1990	R.A.F. Grieve, 1990, <i>Scientific American</i>, 262(4), 66, "Impact cratering on the Earth." See: http://adsabs.harvard.edu/abs/1990SciAm.262...44G
1990	E.F. Helin, R.S. Dunbar, 1990, <i>Vistas in Astronomy</i>, 33, 21, "Search techniques for near-earth asteroids." See: http://adsabs.harvard.edu/abs/1990VA.....33...21H
1990, Feb	Chapman, C.R., Morrison, D., 1990, <i>Mercury</i>, 19, 21; 19, 30, "Cosmic impacts, cosmic catastrophes. II." See: http://adsabs.harvard.edu/abs/1990Mercu..19..21C

1990, Feb 19	Aten NEA 2019 ED ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 2.04 LD. Minimum miss distance 0.21 LD. See: 2019 ED– S2P , 2019 ED – JPL
1990, Mar	D. Morrison, C.R. Chapman, 1990, <i>Sky & Telescope</i> , 79, 261, "Target Earth – it will happen." See: http://adsabs.harvard.edu/abs/1990S%26T....79..261M
1990, Apr	American Institute of Aeronautics and Astronautics (AIAA), recommendations concerning NEOs to US Congress in a Position Paper <i>Dealing with the Threat of an Asteroid Striking the Earth</i> . See: http://pdf.aiaa.org/downloads/publicpolicypositionpapers//Asteroid-1990.pdf
1990, Apr 7	Glanerbrug meteorite . A fireball seen by hundreds of people in the Netherlands, Germany and Denmark resulted in an impact of an 885 g meteorite, riddling the roof of a home in Glanerbrug (the Netherlands). See: http://www.sterrenkunde.nl/index/encyclopedie/meteoren.html http://nl.wikipedia.org/wiki/Glanerbrug_meteoriet http://en.wikipedia.org/wiki/Meteorite_fall
1990, Apr 26	C.R. Chapman, 1990, <i>Nature</i> , 344, 813, "Meteorite parent bodies." See: http://adsabs.harvard.edu/abs/1990Natur.344..813C
1990, Jul 7	Aten NEA 2018 NX ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 7.51 LD. Minimum miss distance 0.60 LD. See: 2018 NX - SSA , 2018 NX - JPL See also: 7 July 2018 , 5 July 2086 .
1990, Jul 25	Apollo NEA 2013 PG10 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 6.66 LD. Minimum miss distance 0.64 LD. See: 2013 PG10 - SSA , 2013 PG10 - JPL See also: 24 Jul 2041 .
1990, Sep	US Congress House in NASA Multiyear Authorization Act of 1990: "... imperative that detection rate of Earth-orbit-crossing asteroids must be increased substantially, and that means to destroy or alter orbits ... should be defined and agreed internationally. ..."
1990, Sep 19	Aten NEA 2003 SW130 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.54 LD. Minimum miss distance 0.46 LD. [1990-01] See: 2003 SW130 - JPL , 2003 SW130 - SSA See also: 19 Sept 2003 .
1990, Oct 13	Earth-grazing fireball , a 40 kg asteroid passing 98 km above

	Czechoslovakia and Poland with 41.5 km/s. Ref: - P. Spurný, Z. Ceplecha, J. Borovička, 1991, <i>WGN, the Journal of the IMO</i>, 19, 13, "Earth-grazing fireball: Czechoslovakia, Poland, October 13, 1990, 03h27m16sUT." See: http://adsabs.harvard.edu/abs/1991JIMO...19...13S - J. Borovička, Z. Ceplecha, 1992, <i>Astronomy & Astrophysics</i>, 257, 323, "Earth-grazing fireball of October 13, 1990." See: http://adsabs.harvard.edu/abs/1992A%26A...257..323B See also: http://en.wikipedia.org/wiki/Earth-grazing_fireball
1990, Nov 10	Apollo NEA 2019 VF5 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 6.49 LD. Minimum miss distance 0.38 LD. See: 2019 VF5 – SSA , 2019 VF5 - JPL See also: 9 Nov 2019.
1990, Dec	A. Milani, M. Carpino, F. Marzari, 1990, <i>Icarus</i>, 88, 292, "Statistics of close approaches between asteroids and planets: project SPACEGUARD." See: http://adsabs.harvard.edu/abs/1990Icar...88..292M
1991	US Congresssional Statement 1991: "The House Committee on Science and Technology believes that it is imperative that the detection rate of Earth-orbit-crossing asteroids must be increased substantially, and that the means to destroy or alter the orbits of asteroids when they do threaten collisions should be defined and agreed upon internationally. The chances of the Earth being struck by a large asteroid are extremely small, but because the consequences of such a collision are extremely large, the Committee believes it is only prudent to assess the nature of the threat and prepare to deal with it." NASA Authorization Bill, 1991. The US Congress House Committee on Science and Technology used NASA Authorization Bill to direct NASA to study (1) a programme to increase detection rate of Earth-orbit-crossing asteroids addressing costs, schedule, technology and equipment (Spaceguard Survey Report); (2) systems and technologies to destroy or alter orbits of such asteroids if they should pose a danger to life on Earth (NEO Interception Workshop). See: http://impact.arc.nasa.gov/gov_cong_hearings_1.cfm
1991	The 5000th minor planet was numbered at the IAU Minor Planet Center, Main-belt asteroid 5000 IAU (1987 QN7, $H = 14.3$ mag, $D \approx 5000$ m), discovered on 23 August 1987 by Eleanor F. Helin (1932 – 2009) at Palomar Observatory (CA, USA). See: 1987 QN7 - JPL , 5000 IAU - SSA , http://en.wikipedia.org/wiki/5000_IAU

1991, Jan 18	Apollo NEA 1991 BA ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.36 LD. [1991-01] See: 1991 BA - JPL , 1991 BA - SSA See also: http://en.wikipedia.org/wiki/1991_BA Ref: - D. Steel, 1991, <i>Nature</i>, 354, 265, "Our asteroid-pelted planet". See: http://adsabs.harvard.edu/abs/1991Natur.354..265S - J.V. Scotti, D.L. Rabinowitz, B.G. Marsden, 1991, <i>Nature</i>, 354, 287, "Near miss of the Earth by a small asteroid." See: http://adsabs.harvard.edu/abs/1991Natur.354..287S
1991, Feb 15	Aten NEA 2020 CL1 ($H = 20.0$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 8.46 LD. Minimum miss distance 8.43 LD. See: 2020 CL1 – S2P , 2020 CL1 – JPL See also: 15 Feb 1940, 15 Feb 2036, 14 Feb 2081, 16 Feb 2118.
1991, Mar	P. Hut, E.M. Shoemaker, W. Alvarez, A. Montanari, 1991, <i>Abstracts of the Lunar and Planetary Science Conference</i>, 22, 603, "Astronomical mechanisms and geologic evidence for multiple impacts on Earth." See: http://adsabs.harvard.edu/abs/1991LPI....22..603H
1991, Apr	D.L. Rabinowitz, 1991, <i>Astronomical Journal</i>, 101, 1518, "Detection of earth-approaching asteroids in near real time." See: http://adsabs.harvard.edu/abs/1991AJ....101.1518R
1991, Apr 8	Apollo NEA 2012 UE34 ($H = 23.1$ mag, $D \approx 90$ m) passed Earth at a nominal miss distance of 0.86 LD. Minimum miss distance 0.86 LD. [1991-02] See: 2012 UE34 - JPL , 2012 UE34 - SSA See also: https://en.wikipedia.org/wiki/2012_UE34 See also: 8 Apr 2041.
1991, Apr/May	Workshop on Hazards Due to Comets and Asteroids (1), San Juan Capistrano (CA, USA). Proceedings: T. Gehrels, M.S. Matthews & A.M. Schumann (eds.), 1994, <i>Hazards Due to Comets and Asteroids</i> (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/1994hdtc.conf....G http://www.ips.gov.au/IPSHosted/neo/info/refers/Bk_Hazards_Gehrels.htm
1991, May 7	Benešov Bolide detected and observed at the Czech stations of the

	European Fireball Network on 7 May 1991, one of the brightest and best-documented bolides. Ref: - J. Borovicka, O.P. Popova, I.V. Nemtchinov, et al., 1998, <i>Astronomy & Astrophysics</i>, 334, 713, "Bolides produced by impacts of large meteoroids into the Earth's atmosphere: comparison of theory with observations. I. Benešov Bolide dynamics and fragmentation." - See: http://adsabs.harvard.edu/abs/1998A%26A...337..591B - N.G. Barri, V.P. Stulov, 2003, <i>Solar System Research</i>, 37, 302, "Peculiarities of the fragmentation of Benešov's Bolide." - See: http://adsabs.harvard.edu/abs/2003SoSyR..37..302B
1991, Jun 24-28	International conference on Asteroids, Comets, Meteors, IV, Flagstaff, (AZ, USA). Proceedings: A.W. Harris & E.L.G. Bowell (eds.), 1992, <i>Asteroids, Comets, Meteors 1991</i> (Houston: Lunar & Planetary Institute). See: http://adsabs.harvard.edu/abs/1992acm..proc.....H
1991, June 30 – Jul Sep 24-25 Nov 5	NASA International NEO Detection Workshops, (1st) San Juan Capistrino Research Institute; (2nd) NASA Ames Research Center; (3rd) Palo Alto (CA, USA).
1991, Aug	IAU XXI General Assembly, Buenos Aires (Argentina). Resolution by IAU Commission 20 on <i>Positions and Motions of Asteroids, Comets and Satellites</i>, under the presidency of Richard West, calling for an IAU Inter-Commission Working Group on Near Earth Objects (WG-NEO). See: http://web.mit.edu/rpb/wgneo/
1991, Sep	R.A.F. Grieve, 1991, <i>Meteoritics</i>, 26, 175, "Terrestrial impact – the record in the rocks." See: http://adsabs.harvard.edu/abs/1991Metic..26..175G
1991, Sep	G.L. Verschuur, 1991, <i>Astronomy</i>, 19, No. 9, p. 50, "The end of civilization." See: http://adsabs.harvard.edu/abs/1991Ast....19...50V
1991, Sep 1	A.R. Hildebrand, G.T. Penfield, D.A. Kring, et al., 1 September 1991, <i>Geology</i>, 19, 867, "Chicxulub Crater: A possible Cretaceous/Tertiary boundary impact crater on the Yucatán Peninsula, Mexico." See: https://pubs.geoscienceworld.org/gsa/geology/article-abstract/19/9/867/205322/chicxulub-crater-a-possible-cretaceous-tertiary?redirectedFrom=fulltext See also:

	https://neo.ssa.esa.int/documents/20126/0/Newsletter+September+2021.pdf/
1991, Oct	S.J. Ostro, R.F. Jurgens, K.D. Rosema, R. Winkler, D.K. Yeomans, D.B. Campbell, J.F. Chandler, I.I. Shapiro, A.A. Hine, R. Velez, 1991, <i>Astronomical Journal</i> , 102, 1490, "Asteroid radar astrometry." See: http://adsabs.harvard.edu/abs/1991AJ....102.1490O
1991, Oct 10-11	All-Union conference The Asteroid Hazard , St. Petersburg (Russian Federation). Proceedings in Russian.
1991, Oct 29	NASA spacecraft Galileo flew by asteroid 951 Gaspra (1916 S45, H = 11.6 mag, D = 18.2 × 10.5 × 8.9 km, Main-belt asteroid) at a distance of 1600 km. See: 1916 S45 - JPL , 951 Gaspra - SSA See also: http://en.wikipedia.org/wiki/951_Gaspra Ref: - J. Veverka, M. Belton, K. Klaasen, C. Chapman, 1994, <i>Icarus</i> , 107, 2, "Galileo's encounter with 951 Gaspra : overview." See: http://adsabs.harvard.edu/abs/1994Icar..107....2V
1991, Nov	G.L. Verschuur, 1991, <i>Air and Space</i> , vol. 6, Oct.-Nov. 1991, p. 88, "This target earth." See: http://adsabs.harvard.edu/abs/1991AirSp...6...88V
1991, Nov 28	J.V. Scotti, D.L. Rabinowitz, B.G. Marsden, 1991, <i>Nature</i> , 354, 287, "Near miss of the earth by a small asteroid." See: http://adsabs.harvard.edu/abs/1991Natur.354..287S
1991, Dec	S.J. Ostro, 1991, <i>Meteoritics</i> , 26, 381, "Radar constraints on asteroid metal abundances and meteorite associations." See: http://adsabs.harvard.edu/abs/1991Metic..26R.381O
1991, Dec	A. Cellino, V. Zappalà, P. Farinella, 1991, <i>Monthly Notices Royal Astronomical Society</i> , 253, 561, "The size distribution of main-belt asteroids from IRAS data." See: http://adsabs.harvard.edu/abs/1991MNRAS.253..561C The IRAS data base on asteroid albedos and diameters has been used to derive size distributions for a set of ~ 4000 numbered main-belt asteroids.
1991, Dec	T. Gehrels, 1991, <i>Space Science Reviews</i> , 58, 347, "Scanning with charge-coupled devices." See: http://adsabs.harvard.edu/abs/1991SSRv...58..347G
1992	E. Tollmann, A. Tollmann, 1992, <i>Mitt. Österr. Geol. Ges.</i> , 84, 1,

	"The Flood Impact." On Tollmann's hypothetical bolide. See: http://en.wikipedia.org/wiki/Tollmann's_hypothetical_bolide
1992	C. Sagan, 1992, <i>Bulletin of the Atomic Scientists</i>, 48, 24, "Between enemies." See: http://en.wikiquote.org/wiki/Carl_Sagan
1992, Jan	Workshop on Hazards Due to Comets and Asteroids (2), Los Alamos (NM, USA). Proceedings: T. Gehrels, M.S. Matthews & A.M. Schumann (eds.), 1994, <i>Hazards Due to Comets and Asteroids</i> (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/1994hdtc.conf.....G http://www.ips.gov.au/IPSHosted/neo/info/refers/Bk_Hazards_Gehrels.htm
1992, Jan 11	Apollo NEA 2016 AH164 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 1.37 LD. Minimum miss distance 0.0090 LD (= 0.54 R_{Earth} from the geocenter). See: 2016 AH164- JPL , 2016 AH164- SSA See also: 12 Jan 2016.
1992, Jan 14-16	NASA NEO Interception Workshop, Los Alamos (NM, USA). Full investigation of counter-measures concluded that nuclear explosives in stand-off mode most likely to succeed. Proceedings: G. Canavan, J. Solem, D.G.Rather (eds.), 1993, LANL 12476-C. See: http://adsabs.harvard.edu/abs/1994hdtc.conf...93C
1992, Jan 16	Aten NEA 2021 CZ2 ($H = 22.5$ mag, $D \approx 110$ m) passed Earth at a nominal miss distance of 9.31 LD. Minimum miss distance 0.22 LD. See: 2021 CZ2 – S2P , 2021 CZ2 – JPL
1992, Jan 25	<i>The Spaceguard Survey: Report of the NASA International NEO Detection Workshop</i>, D. Morrison (ed.), 1992 (Washington DC: NASA). Delivered to US Congress. Recommends a search programme and international collaboration to find objects with $D > 1$ km; and the provision of six ground based telescopes, northern and southern hemisphere sites, southern hemisphere radar; half costs to come from international partners. See: http://impact.arc.nasa.gov/downloads/spacesurvey.pdf The term Spaceguard loosely refers to a number of efforts to discover and study NEOs. The British author Arthur C. Clarke (1917 – 2008) coined the name in his novel <i>Rendezvous with Rama</i> (London: Victor Gollancz, 1973) where Spaceguard was the name of an early warning system. The name was later adopted by a number of

	real life efforts to discover and study NEOs. The IAU Working Group on Near-Earth Objects (WG-NEO) presented a paper in September 1995 entitled <i>Beginning the Spaceguard Survey</i>, which led on 26 March 1996 to the international organization called the Spaceguard Foundation (SGF). See: http://spaceguard.iasf-roma.inaf.it/SGF/history.html http://en.wikipedia.org/wiki/Spaceguard Ref: - A.W. Harris, 2008, <i>Nature</i>, 453, 1178, "What Spaceguard did." See: http://adsabs.harvard.edu/abs/2008Natur.453.1178H
1992, Apr	G.L. Vershuur, 1992, <i>Astronomy</i>, 20(4), 46, "Mysterious sungrazers." See: http://adsabs.harvard.edu/abs/1992Ast....20...46V
1992, May	M. Pilkington, R.A.F. Grieve, 1992, <i>Reviews of Geophysics</i>, 30, 161, "The geophysical signature of terrestrial impact craters." See: http://adsabs.harvard.edu/abs/1992RvGeo..30..161P
1992, Jun	G.H. Canavan, J. Solem, May-June 1992, <i>Mercury</i>, 21(3), 107, "Interception of near-earth objects." See: http://adsabs.harvard.edu/abs/1992Mercur..21..107C
1992, Jun	D. Morrison, 1992, <i>Mercury</i>, 21, 103, "The Spaceguard Survey – protecting the earth from cosmic impacts." See: http://adsabs.harvard.edu/abs/1992Mercur..21..103M
1992, Jun 5	Apollo NEA 2017 CH1 ($H = 17.7$ mag, $D \approx 1000$ m, PHA) passed Earth at a nominal miss distance of 4.49 LD. Minimum miss distance 4.42 LD. See: 2017 CH1 - JPL , 2017 CH1 - SSA
1992, Jul	H.A. Thronson, J.K. Davies, J. Hackwell, et al., 1992, <i>Space Science Reviews</i>, 61, 145, "EDISON - the next generation infrared space observatory." See: http://adsabs.harvard.edu/abs/1992SSRv...61..145T
1992, Jul 6-12	International Conference on Meteoroids and their parent bodies, Smolenice (Slovakia). Proceedings: J. Stohl & I.P. Williams (eds.), 1993 (Bratislava: Astronomical Institute, Slovak Academy of Sciences). See: http://adsabs.harvard.edu/abs/1993mtpb.conf.....S
1992, Jul 10	ESA spacecraft Giotto flyby of comet Grigg-Skjellerup. Ref: - J.A.M. McDonnell, N. McBride, R. Beard, et al., 1993, <i>Nature</i>, 362,

	732, "Dust particle impacts during the Giotto encounter with comet Grigg-Skjellerup." See: http://adsabs.harvard.edu/abs/1993Natur.362..732M - S.M.P. McKenna-Lawlor, P.W. Daly, E. Kirsch, et al., 1993, <i>Nature</i>, "Energetic ions at comet Grigg-Skjellerup measured from the Giotto spacecraft." See: http://adsabs.harvard.edu/abs/1993Natur.363..326M See also: http://hubble.esa.int/science-e/www/area/index.cfm?fareaid=15 http://www.esa.int/SPECIALS/Rosetta/SEMMA0YTVKG_0.html
1992, Aug 7	R.P. Binzel, S. Xu, S.J. Bus, E. Bowell, 1992, <i>Science</i>, 257, 779, "Origins for the Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/1992Sci...257..779B
1992, Aug 8	Apollo NEA 2021 AY5 ($H = 24.9$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 5.18 LD. Minimum miss distance 0.0043 LD (= 0.26 R_{Earth} from the geocenter). See: 2021 AY5 – S2P , 2021 AY 5 – JPL
1992, Sep	Z. Ceplecha, 1992, <i>Astronomy & Astrophysics</i>, 263, 361, "Influx of interplanetary bodies onto earth." See: http://adsabs.harvard.edu/abs/1992A%26A...263..361C
1992, Oct 9	Peekskill Fireball and Meteorite. A fireball was seen streaking across the sky from Kentucky to New York. At least 14 people captured part of the fireball on videotape. A 12-kilogram stony meteorite (chondrite) from the fireball fell in Peekskill (NY, USA), smashed the trunk of a parked automobile and came to rest beneath it. Ref: - Z. Ceplecha, P. Brown, R.L. Hawkes, 1994, <i>Meteoritics</i>, 29, 455, "Video observations of the Peekskill meteorite fireball: atmospheric trajectory and orbit." See: http://adsabs.harvard.edu/abs/1994Metic..29Q.455C - P. Brown, Z. Ceplecha, R.L. Hawkes, et al., 1994, <i>Nature</i>, 367, 624, "The orbit and atmospheric trajectory of the Peekskill meteorite from video records." See: http://adsabs.harvard.edu/abs/1994Natur.367..624B See also: http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level2/peekskill.html http://csep10.phys.utk.edu/astr161/lect/meteors/impacts.html http://uregina.ca/~astro/mb_5.html http://www.lifeslittlemysteries.com/1535-when-space-attacks-6-craziest-meteor-impacts-history.html http://apod.nasa.gov/apod/ap021118.html http://apod.nasa.gov/apod/ap061119.html http://apod.nasa.gov/apod/ap110123.html

1992, Oct 21	Apollo NEA 2020 HN3 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.89 LD. Minimum miss distance 0.85 LD. [1992-01] See: 2020 HN3 – S2P , 2020 HN3 - JPL
1992, Nov 23	J. Impocco, J.F. Podevin, 1992, <i>Newsweek</i>, 23 November 1992, Vol. 120, No. 21, "Doomsday science - New theories about comets, asteroids and how the world might end." See: http://www.amazon.com/Newsweek-November-DOOMSDAY-THEORIES-ASTEROIDS/dp/B0054K8T0E
1992, Dec 3	T.J. Ahrens, A.W. Harris, 1992, <i>Nature</i>, 360, 429, "Deflection and fragmentation of near-Earth asteroids." See: http://adsabs.harvard.edu/abs/1992Natur.360..429A
1992, Dec 8	Apollo NEA 4179 Toutatis (1989 AC, $H = 15.2$ mag, $D \approx 4.6 \times 2.4 \times 1.9$ km, orbital $P = 4.03$ yr, PHA) passed Earth at 9.40 LD. Minimum miss distance 9.40 LD. It is the largest known PHA. See: 1989 AC - JPL , 4179 Toutatis - SSA Ref: - R.S. Hudson, S.J. Ostro, D.J. Scheeres, 2003, <i>Icarus</i>, 161, 346, "High-resolution model of asteroid 4179 Toutatis." See: http://adsabs.harvard.edu/abs/2003Icar..161..346H See also: http://science.nasa.gov/science-news/science-at-nasa/2000/ast31oct_1/ http://en.wikipedia.org/wiki/4179_Toutatis See also: 30 Nov 1996, 31 Oct 2000, 29 Sep 2004, 9 Nov 2008, 12 Dec 2012, 5 Nov 2069.
1993	NASA Planetary Astronomy Program Office begins ramp up of funding for NEO observations.
1993	Major L.N. Johnson, 1993, White Paper, presented to SPACECAST 2020, "Preparing for Planetary Defense: detection and interception of asteroids on collision course with Earth." In this paper the term Planetary Defense was coined. See: http://www.fas.org/spp/military/docops/usaf/2020/app-r.htm
1993	Photographic asteroid and comet search project started by Timothy B. Spahr and C. Hergenrother (LPL, Univ. of Arizona). This project eventually evolved into the Catalina Sky Survey in 1998. Ref: - T.B. Spahr, C. Hergenrother, S.M. Larson, 1993, <i>Bulletin of the American Astronomical Society</i>, 25, 1059, "High ecliptic latitude asteroid and comet search."

	See: http://adsabs.harvard.edu/abs/1993DPS....25.1013S
1993	Arthur C. Clarke (1917-2008, UK/Sri Lanka), 1993, <i>The Hammer of God</i> (London: Victor Gollancz Ltd). See: http://en.wikipedia.org/wiki/The_Hammer_of_God
1993	R.A.F. Grieve, 1993, <i>Vistas in Astronomy</i> , 36, 203, "Impact craters: lessons from and for the Earth." See: http://adsabs.harvard.edu/abs/1993VA.....36..203G
1993	F.E. Wickman, 1993, <i>Swedish Geol. Journal</i> , 115, 29, "Eight pound ball fell on the ship and killed two boatmen." An eight-pound meteorite hit the Dutch VOC ship <i>Malacca</i> , sailing from Holland to Batavia (Java, Netherlands-Indies) in 1648, allegedly killing two sailors. Story based on book <i>Reesa till Ostindien jempte een kort berättelse om konungerijket Japan</i> (1674) by 17 th century Swedish historian-turned sailor Olof Eriksson Willman, who travelled the Netherlands-Indies in 1647 – 1653. See also: http://sv.wikipedia.org/wiki/Olof_Eriksson_Willman
1993, Jan 7	C.F. Chyba, P.J. Thomas, K.J. Zahnle, 1993, <i>Nature</i> , 361, 40, "The 1908 Tunguska explosion: atmospheric disruption of a stony asteroid." See: http://adsabs.harvard.edu/abs/1993Natur.361...40C
1993, Jan 7-12	Workshop on Hazards Due to Comets and Asteroids (3) , Tucson (AZ, USA). Proceedings: T. Gehrels, M.S. Matthews & A.M. Schumann (eds.), 1994, <i>Hazards Due to Comets and Asteroids</i> (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/1994hdtc.conf.....G http://www.ips.gov.au/IPSHosted/neo/info/refers/Bk_Hazards_Gehrels.htm
1993, Jan 19	Lugo Fireball and Airburst (Northern, Italy). See: http://www.ta3.sk/caosp/Eedition/FullTexts/vol24/pp117-124.pdf http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1993, Feb	P. Farinella, R. Gonczi, Ch. Froeschlé, C. Froeschlé, 1993, <i>Icarus</i> , 101, 174, "The injection of asteroid fragments into resonances." See: http://adsabs.harvard.edu/abs/1993Icar..101..174F
1993, Mar	J.G. Hills, M.P. Goda, 1993, <i>Astronomical Journal</i> , 105, 1114, "The fragmentation of small asteroids in the atmosphere." See: http://adsabs.harvard.edu/abs/1993AJ....105.1114H

1993, Mar	European Science Foundation (ESF) initiates new scientific network " Impact Cratering and Evolution of Planet Earth ." This led to the submission of a Research Networking Programme proposal in 1998, "Response of the Earth System to Impact Processes (IMPACT)", approved for five years, 1998 to 2002. Four workshops were held in 2002 – 2003." See: http://www.esf.org/impact
1993, Mar 24	U.S. Congressional Hearing on NEOs and Planetary Defense: "The Threat of Large Earth-Orbit Crossing Asteroids." See: http://impact.arc.nasa.gov/gov_earthasteroids_1.cfm
1993, Apr	D.L. Rabinowitz, 1993, <i>Astrophysical Journal</i> , 407, 412, "The size distribution of the Earth-approaching asteroids." See: http://adsabs.harvard.edu/abs/1993ApJ...407..412R
1993, Apr	J.C. Solem, 1993, <i>Journal of Spacecraft and Rockets</i> , 30 (2), 222, "Interception of comets and asteroids on collision course with Earth." See: http://adsabs.harvard.edu/abs/1993JSpRo..30..222S
1993, Apr 10	Apollo NEA 2021 TS10 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 4.88 LD. Minimum miss distance 0.50 LD. See: 2021 TS10 – S2P , 2021 TS10 – JPL
1993, May	Workshop on Hazards Due to Comets and Asteroids (4) , Erice (Italy). Proceedings: T. Gehrels, M.S. Matthews & A.M. Schumann (eds.), 1994, <i>Hazards due to Comets and Asteroids</i> (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/1994hdtc.conf.....G http://www.ips.gov.au/IPSHosted/neo/info/refers/Bk_Hazards_Gehrels.htm
1993, May 20	Apollo NEA 1993 KA2 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [1993-01] See: 1993 KA2 - JPL , 1993 KA2 - SSA
1993, Jun 14-18	IAU Symposium No. 160 on Asteroids, Comets, Meteors, V , Belgirate (Italy). Proceedings: A. Milani, M. Di Martino & A. Cellino (eds.), 1994, <i>Asteroids, Comets, Meteors 1993</i> (Dordrecht: Kluwer). See: http://adsabs.harvard.edu/abs/1994IAUS..160.....M
1993, Jun 24	C.F. Chyba, 1993, <i>Nature</i> , 363, 701, "Explosions of small

	Spacewatch objects in the Earth's atmosphere." See: http://adsabs.harvard.edu/abs/1993Natur.363..701C
1993, Jun 24	D.L. Rabinowitz, T. Gehrels, J.V. Scotti, et al., 1993, <i>Nature</i>, 363, 704, "Evidence for a near-Earth asteroid belt." See: http://adsabs.harvard.edu/abs/1993Natur.363..704R
1993, Jul	D. Morrison, 1993, in: Proc. IAF 43rd International Astronautical Congress, Washington DC (USA), 28 August – 5 September 1992, <i>Acta Astronautica</i>, 30, 11, "An international program to protect the earth from impact catastrophe: Initial steps." See: https://ui.adsabs.harvard.edu/abs/1993AcAau..30...11M/abstract
1993, Aug 17	Tom Gehrels' <i>Vainu Bappu Lecture</i>, presented to the 6th Asian-Pacific Regional IAU Meeting, 16-20 August, Pune (India). Ref.: T. Gehrels, 1995, <i>J. Astrophys. Astr. Suppl.</i>, 16, 1, "The beauty and danger of comets and asteroids." See: http://adsabs.harvard.edu/abs/1995JApAS..16....1G
1993, Aug 28	NASA spacecraft Galileo flew by asteroid 243 Ida ($H = 9.94$ mag, $D = 59.8 \times 25.4 \times 18.6$ km, Main-belt asteroid) at a distance of 10,300 km, and discovered binary component Dactyl ($D = 1.4$ km), orbiting Ida at a distance of 56 km. See: 243 Ida - JPL , 243 Ida - SSA Ref: - E. Asphaug, 2004, in: M.J.S. Belton, et al. (eds.), <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 66, "Interior structures for asteroids and cometary nuclei". See: http://adsabs.harvard.edu/abs/2004mhca.conf...66A See also: http://www2.jpl.nasa.gov/galileo/sepo/cruise/ida/ida.html http://en.wikipedia.org/wiki/243_Ida
1993, Sep	S. Larson, J. Brownlee, C. Hergenrother, T. Spahr, 1993, <i>AAS-DPS meeting #30</i>, id.12.P14; <i>Bulletin of the American Astronomical Society</i>, 30, 1037, "The Catalina Sky Survey for NEOs." See: http://adsabs.harvard.edu/abs/1998BAAS...30.1037L
1993, Nov	P. Farinella, B. Chauvineau, 1993, <i>Astronomy & Astrophysics</i>, 279, 251, "On the evolution of binary Earth-approaching asteroids." See: http://adsabs.harvard.edu/abs/1993A%26A...279..251F
1993, Nov	Z. Ceplecha, P. Spurný, J. Borovička, J. Keclíková, 1993, <i>Astronomy & Astrophysics</i>, 279, 615, "Atmospheric fragmentation of meteoroids." See: http://adsabs.harvard.edu/abs/1993A%26A...279..615C

1993, Nov 4	H.J. Melosh, I.V. Nemchinov, 1993, <i>Nature</i> , 366, 21, "Solar asteroid diversion." See: http://adsabs.harvard.edu/abs/1993Natur.366...21M
1993, Dec	D.J. Asher, S.V.M. Clube, 1993, <i>Quarterly Journal Royal Astronomical Society</i> , 34, 481, "An extraterrestrial influence during the current Glacial-Interglacial." See: http://adsabs.harvard.edu/abs/1993QJRAS..34..481A
1993, Dec 31	Aten NEA 2021 AX6 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 3.40 LD. Minimum miss distance 0.71 LD. See: 2021 AX6 – S2P , 2021 AX6 – JPL
1994	T. Gehrels, M.S. Matthews & A.M. Schumann (eds.), 1994, <i>Hazards Due to Comets and Asteroids</i> (Tucson: Univ. of Arizona Press). Proceedings of four Workshops in April/May 1991, January 1992, January 1993, and May 1993. See: http://adsabs.harvard.edu/abs/1994hdtc.conf....G http://ips.gov.au/IPSHosted/neo/info/refers/Bk_Hazards_Gehrels.htm
1994	R.Z. Akhmetshin, V.V. Ivashkin, V.V. Smirnov, 1994, <i>Astronomicheskij Vestnik</i> , 28, 13, "An analysis of the possibility of asteroid hazard mitigation for the Earth by the impact of a spacecraft." See: http://adsabs.harvard.edu/abs/1994AVest..28...13A
1994	D.J. Asher, S.V.M. Clube, W.M. Napier, D.I. Steel, 1994, <i>Vistas in Astronomy</i> , 38, 1, "Coherent catastrophism." See: http://adsabs.harvard.edu/abs/1994VA.....38....1A
1994	E. Kristan-Tollmann, A. Tolmann, 1994, <i>Terra Nova</i> , 6, 209, "The youngest big impact on Earth deduced from geological and historical evidence." See: http://en.wikipedia.org/wiki/Tollmann's_hypothetical_bolide
1994	A. Deutsch, C. Koeberl, J.D. Blum, et al., 1994, <i>Terra Nova</i> , 6, 644, "The impact-flood connection: does it exist?" See: http://en.wikipedia.org/wiki/Tollmann's_hypothetical_bolide
1994, Jan	A.W. Harris, 1994, <i>Icarus</i> , 107, 209, "Tumbling asteroids." See: http://adsabs.harvard.edu/abs/1994Icar..107..209H
1994, Jan 6	C.R. Chapman, D.D. Morrison, 1994, <i>Nature</i> , 367, 33, "Impacts on the Earth by asteroids and comets: assessing the hazard." See: http://adsabs.harvard.edu/abs/1994Natur.367...33C

1994, Jan 18	Cando Fireball and Airburst (Spain). See: http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1994, Feb	P. Spurný, 1994, <i>Planetary and Space Science</i> , 42, 157, "Recent fireballs photographed in central Europe." See: http://adsabs.harvard.edu/abs/1994P%26SS...42..157S
1994, Feb	US Congress House Committee on Science and Technology passed an amendment to NASA Authorization Bill directing NASA to report within a year with a programme to identify and catalogue, with help from the Department of Defense and space agencies of other countries, within 10 year, orbital characteristics of all comets and asteroids with $D > 1$ km and in an orbit that crosses Earth's. See: http://impact.arc.nasa.gov/gov_cong_hearings_1.cfm
1994, Feb 1	Marshall Islands Fireball and Airbursts . A large meteoroid impacted over the Pacific Ocean at 2.6° N, 164.1° E, 300 km south of Kosrae (Micronesia). The impact was observed by space-based infrared sensors operated by the U.S. Department of Defense and by visible wavelength sensors operated by the U.S. Department of Energy. The object produced a 11 kT explosion. During entry the object broke into several pieces, one of which detonated at 34 km and another at 21 km altitude. $M \approx 1.6 \times 10^5$ kg - 4.4×10^6 kg; $D \approx 4.4$ - 13.5 m. Ref: - E. Tagliaferri, R. Spalding, C. Jacobs, Z. Ceplecha, 1995, <i>Earth, Moon, and Planets</i> , 68, 563, "Analysis of the Marshall Island Fireball of February 1, 1994." See: http://adsabs.harvard.edu/abs/1995EM%26P...68..563T - T.B. McCord, J. Morris, D. Persong, et al., 1995, <i>Journal of Geophysical Research</i> , 100, E2, 3245, "Detection of a meteoroid entry into the Earth's atmosphere on February 1, 1994." See: http://adsabs.harvard.edu/abs/1995JGR...100.3245M - E. Tagliaferri, 1998, <i>Mercury</i> , 27, no.6, p.18, "Observation of meteoroid impacts by space-based sensors." See: http://adsabs.harvard.edu/abs/1998Mercu..27f..18T See also: http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
1994, Mar 15	Apollo NEA 1994 ES1 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [1994-01] See: 1994 ES1 - JPL , 1994 ES1 - SSA
1994, Apr 7	C. Sagan, S.J. Ostro, 1994, <i>Nature</i> , 368, 501, "Dangers of asteroid deflection." See: http://adsabs.harvard.edu/abs/1994Natur.368..501S

1994, Apr 16	Apollo NEA 2019 UU1 ($H = 30.5$ mag, $D \approx 2.9$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.32 LD. [1994-02] See: 2019 UU1 – SSA , 2019 UU1 - JPL See also: 18 Oct 2019.
1994, May 18	Aten NEA 2017 KJ32 ($H = 28.9$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 7.10 LD. Minimum miss distance 0.27 LD. See: 2017 KJ32 - JPL , 2017 KJ32 - SSA See also: 21 May 2042.
1994, May 26	Apollo NEA 2014 AA ($H = 30.9$ mag, $D \approx 2.3$ m) passed Earth at a nominal miss distance of 184.47 LD. Minimum miss distance 164.67 LD. Impact on 2 January 2014. See: 2014 AA - SSA , 2014 AA - JPL See also: http://www.minorplanetcenter.net/mpec/K14/K14A02.html http://www.jpl.nasa.gov/news/news.php?release=2014-001 https://en.wikipedia.org/wiki/2014_AA See also: 3 Nov 1967, 21 Mar 1996, 2 Jan 2014.
1994, Jun	Z. Ceplecha, 1994, <i>Astronomy & Astrophysics</i>, 286, 967, "Impacts of meteoroids larger than 1 M into the Earth's atmosphere." See: http://adsabs.harvard.edu/abs/1994A%26A...286..967C
1994, Jun 14	St-Robert Daylight Fireball and Meteorite Fall over the Canada-US border, travelling at a velocity of ~ 13 km/s, widely seen from the provinces of Quebec and Ontario and the states of New Hampshire, Vermont and New York at distances up to ~ 500 km. The rock fragmented spectacularly ~ 50 km NE of Montreal at an altitude of ~ 36 km; hundreds of fragments have been found with pieces of up to 6.5 kg. See: http://en.wikipedia.org/wiki/St-Robert_meteorite Ref: - P. Brown, A.R. Hildebrand, D.W. Green, et al., 1996, <i>Meteoritics</i>, 31, 502, "The fall of the St-Robert meteorite." See: http://adsabs.harvard.edu/abs/1996M%26PS...31..502B - A.R. Hildebrand, P.G. Brown, J.F. Wacker, et al., 1997, <i>Journal of the Royal Astronomical Society of Canada</i>, 91, 261, "The St-Robert Bolide of June 14, 1994." See: http://adsabs.harvard.edu/abs/1997JRASC..91..261H
1994, Jun 30	H.J. Melosh, E.A. Whitaker, 1994, <i>Nature</i>, 369, 713, "Lunar crater chains." See: http://adsabs.harvard.edu/abs/1994Natur.369..713M

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1994, Jul	W.F. Bottke, M.C. Nolan, R. Greenberg, 1994, <i>Meteoritics</i> , 29, 446, "Provenance of the spacewatch small Earth-approaching asteroids." See: http://adsabs.harvard.edu/abs/1994Metic..29S.446B
1994, Jul 16-22	Comet Shoemaker-Levy 9 collides with Jupiter. Some 21 cometary fragments with diameters up to ~ 2 km caused massive explosions, temporarily visible on the surface of Jupiter. Ref: - H.A. Weaver, P.D. Feldman, M.F. A'Hearn, et al., 1994, <i>Science</i> , 263, 787, " Hubble Space Telescope observations of comet Shoemaker-Levy 9 (1993e) ." See: http://adsabs.harvard.edu/abs/1994Sci...263..787W - K. Zahnle, M.-M. Mac Low, 1994, <i>Icarus</i> , 108,1, "The collision of Jupiter and comet Shoemaker-Levy 9 ." See: http://adsabs.harvard.edu/abs/1994Icar..108....1Z - M.-M. Mac Low, K. Zahnle, 1994, <i>Astrophysical Journal</i> , 434, 33, "Explosion of comet Shoemaker-Levy 9 on entry into the Jovian atmosphere." See: http://adsabs.harvard.edu/abs/1994ApJ...434L..33M - G. Orton, M. A'Hearn, K. Baines, et al., 1995, <i>Science</i> , 267, 1277, "Collision of comet Shoemaker-Levy 9 with Jupiter observed by the NASA Infrared Telescope Facility." See: http://adsabs.harvard.edu/abs/1995Sci...267.1277O - H.A. Weaver, M.F. A'Hearn, C. Arpigny, et al., 1995, <i>Science</i> , 267, 1282, "The Hubble Space Telescope (HST) observing campaign on comet Shoemaker-Levy 9 ." See: http://adsabs.harvard.edu/abs/1995Sci...267.1282W - D.H. Levy, E.M. Shoemaker, C.S. Shoemaker, 1995, <i>Scientific American</i> , 273, 68, "Comet Shoemaker-Levy 9 meets Jupiter." See: http://adsabs.harvard.edu/abs/1995SciAm.273...68L - D.H. Levy, 1995, <i>Impact Jupiter: the crash of comet Shoemaker-Levy 9</i> (New York: Plenum Press). See: http://adsabs.harvard.edu/abs/1995ijcc.book.....L - J.K. Beatty, D.H. Levy, 1995, <i>Sky & Telescope</i> , 90, 18, "Crashes to ashes: a comet's demise." See: http://adsabs.harvard.edu/abs/1995S%26T....90...18B - K.S. Noll, H.A. Weaver & P.D. Feldman (eds.), 2006, <i>The impact of comet Shoemaker-Levy 9 on Jupiter</i> , Proc. IAU Coll. No. 156, Baltimore (MD, USA) 9-12 May 1995, <i>STScI Symposium Series No. 9</i> (Cambridge: CUP, ISBN-0521-03162-1). See: http://www.iau.org/science/publications/iau/

	See also: http://www.stsci.edu/institute/conference/jupiter-impact http://www2.jpl.nasa.gov/sl9/ http://www.huffingtonpost.com/mark-boslough/unforgettable-shoemakerle_b_2946407.html http://en.wikipedia.org/wiki/Comet_Shoemaker-Levy_9
1994, Aug	W. Tedeschi, E. Teller, 1994, <i>Space Policy</i>, 10, 183, "A plan for worldwide protection against asteroid impacts." See: http://adsabs.harvard.edu/abs/1994SpPol..10..183T
1994, Aug 8-12	<i>Meeting on Small Bodies in the Solar System and their interactions with the planets</i>, Mariehamn (Finland), 8 - 12 August 1994. Proc: H. Rickman, M.J. Valtonen (eds.), 1996, <i>Earth, Moon, Planets</i>, 72, No. 1 - 3, "Worlds in interaction: small bodies and planets of the solar system." See: http://adsabs.harvard.edu/abs/1996EM%26P..72.....R
1994, Aug 20	IAU XXII General Assembly, Den Haag (the Netherlands). The IAU Working Group on Near Earth Objects, chaired by Andrea Carusi, had a science meeting, and presented a report recommending that an international authority should take responsibility for NEO investigations and initiatives. Ref: - I. Appenzeller (ed.), 1996, <i>Transactions IAU XXIIB</i>, (Dordrecht: Kluwer Acad. Publ.), IAU Commission 20 Report, p. 164, "Working Group Meeting 2 on Near-Earth Object Detection." See: http://adsabs.harvard.edu/abs/1996IAUTB..22.....A - J. Tate, 2000, <i>Space Policy</i>, 16, 261, "Avoiding collisions: the Spaceguard Foundation." See: http://ui.adsabs.harvard.edu/abs/2000SpPol..16..261T/abstract
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1994, Sep 26-30	1st International Conference on Space Protection of the Earth (SPE-94), Chelyabinsk, Russian Federation. See: http://www.boulder.swri.edu/clark/ncarhist.html
1994, Oct	D.L. Rabinowitz, 1994, <i>Icarus</i>, 111, 364, "The size and shape of the near-Earth asteroid belt." See: http://adsabs.harvard.edu/abs/1994Icar..111..364R
1994, Nov	K. Yau, P. Weissman, D. Yeomans, 1994, <i>Meteoritics</i>, 29, 864, "Meteorite falls in China and some related human casualty events."

	In February-March of the year 1490 a barrage of stones of 1 – 1.5 kg fell like rain in the Ching-yang district of Shansi Province (China), killing more than 10,000 people. See: http://adsabs.harvard.edu/abs/1994Metic..29..864Y See also: http://www.mail-archive.com/meteorite-list@meteoritecentral.com/msg80757.html http://en.wikipedia.org/wiki/Impact_event
1994, Nov 24	Aten NEA 1994 WR12 ($H = 22.7$ mag, $D \approx 100$ m) passed Earth at a nominal miss distance of 1.85 LD. Minimum miss distance 1.85 LD. See: 1994 WR12 - JPL , 1994 WR12 - SSA See also: http://en.wikipedia.org/wiki/1994_WR12 See also: 25 Nov 2046.
1994, Dec	C. Covey, S.L. Thompson, P.R. Weissman, et al., 1994, <i>Global and Planetary Change</i>, 9, 263, "Global climatic effects of atmospheric dust from an asteroid or comet impact on Earth." See: http://adsabs.harvard.edu/abs/1994GPC.....9..263C
1994, Dec	K. Keil, H. Haack, E.R.D. Scott, 1994, <i>Planetary and Space Science</i>, 42, 1109, "Catastrophic fragmentation of asteroids: evidence from meteorites." See: http://adsabs.harvard.edu/abs/1994P%26SS...42.1109K
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1994, Dec 9	Apollo NEA 1994 XM1 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.27 LD. [1994-03] See: 1994 XM1 - JPL , 1994 XM1 SSA See also: http://spacewatch.lpl.arizona.edu/pics.html http://www.rssd.esa.int/index.php?project=GAIA&page=picture_of_the_week&pow=5
1994, Dec 17	S. Rozendaal, 1994, <i>Elsevier</i>, 17 december 1994, "De catastrophe. Waarom de dino's uitstierven en de mens ontstond."
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	physical observation, and Minor Planet Center enhancements. See:
1995, Jun 24	Apollo NEA 170086 (2002 XR14 , $H = 18.5$ mag, $D \approx 700$ m, PHA) passed Earth at a nominal miss distance of 4.26 LD. Minimum miss distance 4.26 LD. See: 2002 XR14 - JPL , 2002 XR14 - SSA
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1995, Sep 18-22	<i>IAU Working Group on Near Earth Objects Workshop</i> , Vulcano (Italy), <i>Beginning the Spaceguard Survey</i> . The Workshop participants agreed to set up a Spaceguard Foundation , which materialized on 26 September 1996, in Rome. The Spaceguard Central Node (SCN) , hosted by ESA at ESRI (Frascati, Italy) is a web site of The Spaceguard Foundation . Since 2002, the SCN is supporting ESA's Science Programme in all issues related to NEOs. Ref: - J. Tate, 2000, <i>Space Policy</i> , 16, 261, "Avoiding collisions: the Spaceguard Foundation ." See: https://ui.adsabs.harvard.edu/abs/2000SpPol..16..261T/abstract See also: http://cfa-www.harvard.edu/~marsden/SGF/Vulcano/programme.ps http://www.esa.int/esaMI/NEO/SEMS58OVGJE_0.html
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	asteroid similar to the Shoemaker-Levy 9 comet that slammed into Jupiter in 1994. The craters were discovered in radar images of the Earth taken by the Spaceborne Imaging Radar C/X-band Synthetic Aperture Radar (SIR-C/X-SAR) that flew on the Space Shuttle Endeavour in April and October of 1994. Ref: - A.C. Campo, K.O., Pope, 1996, <i>Lunar and Planetary Science</i>, 27, 977, "Shuttle Imaging Radar (SIR-C) images reveal multiple impact craters at Aorounga, Northern Chad." See: http://adsabs.harvard.edu/abs/1996LPI....27..977O
1996, Mar 20	Parliamentary Assembly of the Council of Europe (Strasbourg, France), Resolution 1080: "On the detection of asteroids and comets potentially dangerous to mankind", invited governments of member states and the European Space Agency (ESA) to give the necessary support to an international program to detect NEOs that are potentially dangerous to mankind and to develop a strategy for remedies against possible impacts. See: http://www.cfa.harvard.edu/~marsden/SGF/resol.html
1996, Mar 21	Apollo NEA 2014 AA ($H = 30.9$ mag, $D \approx 2.3$ m, Apollo NEO) passed Mars at a nominal miss distance of 11.86 LD. Minimum miss distance 2.07 LD. Impact on 2 January 2014. See: 2014 AA - SSA , 2014 AA - JPL See also: http://www.minorplanetcenter.net/mpec/K14/K14A02.html http://www.jpl.nasa.gov/news/news.php?release=2014-001 https://en.wikipedia.org/wiki/2014_AA See also: 3 Nov 1967, 26 May 1994, 2 Jan 2014.
1996, Mar 26	Inauguration of the Spaceguard Foundation (SGF), Rome (Italy), founded by E. Shoemaker, D. Steel, A. Carusi and the IAU WG-NEO. The SGF is located at the ESA Centre for Earth Observations (ESRIN) in Frascati (Italy). See: http://www.cfa.harvard.edu/~marsden/SGF/
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1996, May 19	Apollo NEA 1996 JA1 ($H = 20.8$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 1.18 LD. Minimum miss distance 1.18 LD. See: 1996 JA1- JPL , 1996 JA1 - SSA
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1996, Jul 8-12	International conference on Asteroids, Comets, Meteors, VI, Versailles (France). Proc.: A.V. Levasseur-Regourd & M. Fulchignoni (eds.), <i>Asteroids, Comets, Meteors</i> 1996, I: 1996, <i>Planetary and Space Science</i>, 45, No. 5; II: 1997, <i>Planetary and Space Science</i>, 45 No.7; III: 1997, <i>Planetary and Space Science</i>, 45, No.12; <i>Planetary and Space Science</i>, 46, No.8. See: http://adsabs.harvard.edu/abs/1997P%26SS...45.....L http://adsabs.harvard.edu/abs/1998P%26SS...46..835L
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	sources of ordinary chondrite meteorites." See: http://adsabs.harvard.edu/abs/1996Sci...273..946B
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1996, Sep 23-27	2nd International Conference on Space Protection of the Earth (SPE-96) , Snezhinsk/Chelyabinsk (Russian Federation).
1996, Oct	P.M. Sforza, J.L. Remo, 1996, <i>Acta Astronautica</i> , 39, 517, "Propulsion options for missions to near-Earth objects." See: http://adsabs.harvard.edu/abs/1996AcAau..39..517S
1996, Oct	J.M. Urias, I.M. DeAngelis, D.A. Ahern, et al., 1996, paper presented to <i>Air Force 2025</i> , "Planetary Defense: catastrophic health insurance for planet Earth." See: http://csat.au.af.mil/2025/volume3/vol3ch16.pdf
1996, Oct	Start of the OCA-DLR Asteroid Survey (O.D.A.S.) , to search for asteroids and comets with emphasis on NEO's, operated from October 1996 to April 1999 by the Observatoire de Côte d'Azur (OCA, Nice, France) and the DLR – Institute of Planetary Research (Berlin-Adlershof, Germany), in the framework of the EUNEASO project. Five NEAs were discovered. See: http://earn.dlr.de/odas/ http://earn.dlr.de/euneaso.htm
1996, Oct 20	The Japanese Spaceguard Association (JSGA) officially founded. Plans for the future involved two 1-m class ground-based NEO

	telescopes in Japan and a 30-cm NEO telescope on the Moon. A 1-m wide-field telescope for NEO detection became operational in 2002, and observes NEOs down to $v = 20.5$ since 2006. Ref: <i>SGF Information Bulletin</i> No. 1997/01, May 22, 1997, Item 7. See also: http://www.unoosa.org/pdf/reports/ac105/AC105_976E.pdf http://www.oosa.unvienna.org/pdf/reports/ac105/C1/AC105_C1_100E.pdf
1996, Oct 21	Space Shield Foundation established in Russia.
1996, Nov	A.W. Harris, 1996, <i>Mercury</i>, 25, no.6, p.12, "Can we defend Earth against impacts by comets and small asteroids?" See: http://adsabs.harvard.edu/abs/1996Mercu..25f..12H
1996, Nov 12	Founding of Spaceguard UK, set up to promote UK NEO activities. The UK Spaceguard Centre is located at Knighton (Powys, Wales, UK). See: http://www.spaceguarduk.com/ http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_863Add1E.pdf
1996, Nov 22	Honduras bolide. Fireball over San Luis (Honduras). Estimated initial diameter $D \approx 2$ m. No meteorites were recovered. Ref: - NN, 1997, <i>Sky & Telescope</i>, 93, 12, "A hit in Honduras?"; - J. Borovička, C.M. Pineda de Carías, A. Ocampo, et al., 1999, in: W.J. Baggaley & V. Porubcan (eds.), <i>Meteoroids 1998</i>, Proc. Int. Conf., Tatranska Lomnica (Slovakia), 17-21 August 1998 (Slovak Academy of Sciences: Astronomical Institute), "About a big fireball seen in Honduras." See: http://adsabs.harvard.edu/abs/1999md98.conf..139B
1996, Nov 30	Apollo NEA 4179 Toutatis (1989 AC, $H = 15.2$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, orbital $P = 4.03$ yr, PHA) passed Earth at 13.79 LD. It is the largest known PHA. See: 1989 AC - JPL , 4179 Toutatis - SSA See also: http://en.wikipedia.org/wiki/4179_Toutatis 8 Dec 1992, 31 Oct 2000, 29 Sep 2004, 9 Nov 2008, 12 Dec 2012, 5 Nov 2069.
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1997, Jun 27	NASA spacecraft Near Earth Asteroid Rendezvous – Shoemaker (NEAR – Shoemaker) flew within 1200 km by Main-belt asteroid 253 Mathilde (1949 OL1, $H = 10.4$ mag, $D = 66 \times 48 \times 46$ km). See: 1949 OL1 - JPL , 253 Mathilde - SSA See also: http://en.wikipedia.org/wiki/253_Mathilde Ref: - A.F. Cheng, 1997, <i>Space Science reviews</i>, 82, 3, "Near-Earth Asteroid Rendezvous: mission overview." See: http://adsabs.harvard.edu/abs/1997SSRv...82....3C - A.F. Cheng, A.G. Santo, K.J. Heeres, et al., 1997, <i>Journal of Geophysical Research</i>, 102, E10, p. 23695, "Near-Earth Asteroid

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1998, Feb 14	Atira NEA 1998 DK36 ($H = 25.0$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 4.41 LD. Minimum miss distance 0.39 LD. See: 1998 DK36 - JPL , 1998 DK36 - SSA See also: https://en.wikipedia.org/wiki/1998_DK36
1998, Mar 11	B.G. Marsden, 1998, IAU Circular 6837, "1997 XF11." See: http://www.cbat.eps.harvard.edu/iau/06800/06837.html#Item2 http://www.minorplanetcenter.net/iau/pressinfo/1997XF11.html IAU Circular 6837 contained the (later corrected) assertion of a possible impact on Earth by Apollo NEA 35396 (1997 XF11), $H = 17.3$ mag, $D \approx 1600$ m, PHA) on 26 Oct 2028. The ensuing debate on orbit determination, evaluation of impact risks and the dissemination of such results led to considerable activity. Improved analyses predicted an approach distance of 2.42 LD on 26 October 2028. See: 1997 XF11 - JPL , 35396 1997 XF11 - SSA See also: http://www.ibtimes.co.in/would-asteroid-discovered-1997-hit-earth-search-answers-led-much-more-732947 https://en.wikipedia.org/wiki/(35396)_1997_XF1 Ref: - B.G. Marsden, 1998, <i>Boston Sunday Globe</i>, 29 March 1989, "How the asteroid story hit: an astronomer reveals how a discovery spun out of control." See: http://www.minorplanetcenter.net/iau/pressinfo/1997XF11Globe.html - I. Semeniuk, 1998, <i>Mercury</i>, 27, No. 6, p. 12, "Armageddon? ... Sorry, just Armakiddin!"

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1998, Mar 12	J.G. Spray, S.P. Kelley, D.B. Rowley, 1998, <i>Nature</i>, 392, 171, "Evidence for a late Triassic multiple impact event on Earth." See: http://adsabs.harvard.edu/abs/1998Natur.392..171S On the Manicouagan Crater, one of the oldest known impact craters, located in the Côte-Nord region of Québec, Canada, about 300 km north of the city of Baie-Comeau. See: http://en.wikipedia.org/wiki/Manicouagan_crater
1998, Mar 29	B.G. Marsden, 1998, <i>Boston Sunday Globe</i>, 29 March 1989, "How the asteroid story hit: an astronomer reveals how a discovery spun out of control." See: http://www.minorplanetcenter.net/iau/pressinfo/1997XF11Globe.html
1998, Apr	The Catalina Sky Survey came into operation, starting from the ashes of an old photographic project started by Spahr & Hergenrother (1993). The CSS consists of a consortium of three cooperating surveys, all funded by NASA: the original Catalina Sky Survey (CSS, 0.7-m telescope) in Arizona, the Siding Spring Survey (SSS,

	0.5-m telescope) in Australia, and the Mt. Lemmon Survey (MLSS, 1.5-m telescope) in Arizona. As of 2009, CSS had discovered more than 2,142 NEOs down to $v = 22$ mag. Ref: - T.B. Spahr, C. Hergenrother, S.M. Larson, 1993, <i>Bulletin American Astronomical Society</i>, 25, 1059, "High ecliptic latitude asteroid and comet search." See: http://adsabs.harvard.edu/abs/1993DPS....25.1013S - D.K. Yeomans, S.R. Chesley, P.W. Chodas, 2010, in: A.M. Finkelstein, W.F. Huebner & V.A. Shor (eds.), <i>Proc. Intern. Conf. Asteroid-Comet Hazard 2009, Protecting the Earth against collisions with asteroids and comet nuclei</i>, St. Petersburg (Russian Federation), 21-25 September 2009 (Saint Petersburg: Nauka), p. 244, "NASA's Near-Earth Object Program Office." - A.J. Drake, S.G. Djorgovski, A. Mahabal, et al., April 2012, in: R.E. Griffin, R.J. Hanisch, R.L. Seaman (eds.), <i>New horizons in time-domain astronomy</i>, Proceedings IAU Symposium No. 285 (Cambridge: CUP), 306, "The Catalina Real-time Transient Survey." See: http://adsabs.harvard.edu/abs/2012IAUS..285..306D See also: http://www.lpl.arizona.edu/css/ http://uanews.org/node/23277 http://www.space.com/14911-dangerous-asteroids-search-nasa-funding.html http://www.newscientist.com/article/mg21528724.800-vital-eye-for-killer-asteroids-could-shut-imminently.html http://www.canberratimes.com.au/national/funding-black-hole-means-our-asteroid-sentinel-may-abandon-crucial-work-20120710-21ubf.html http://en.wikipedia.org/wiki/Catalina_Sky_Survey
1998, Apr	P. Farinella, D. Vokrouhlický, W.K. Hartmann, 1998, <i>Icarus</i>, 132, 378, "Meteorite delivery via Yarkovsky orbital drift." See: http://adsabs.harvard.edu/abs/1998Icar..132..378F
1998, Apr 10	Apollo NEA 138175 (2000 EE104), $H = 20.7$ mag, $D \approx 260$ m, PHA) passed Earth at a nominal miss distance of 4.46 LD. Minimum miss distance 4.46 LD. See: 2000 EE104- JPL , 2000 EE104- SSA See also: 11 Apr 1999.
1998, Apr 14	Aten NEA 99942 Apophis (2004 MN4), $H = 19.0$ mag, $D = 310 \pm 30$ m, orbital $P = 0.89$ yr, PHA) passed Earth at a nominal miss distance of 9.491 LD. Minimum miss distance 9.490 LD. See: 2004 MN4 - JPL , 99942 Apophis - SSA See also: http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis

	http://en.wikipedia.org/wiki/99942_Apophis See also: 13 Apr 1907, 14 Apr 1949, 14 Apr 1998, 13 Apr 2029, 23 Mar 2036, 11 Sep 2102, 12 Apr 2116, 7 Apr 2123.
1998, May	D.I. Steel, 1998, <i>Planetary and Space Science</i> , 46, 473, "Distributions and moments of asteroid and comet impact speeds upon the Earth and Mars." See: http://adsabs.harvard.edu/abs/1998P%26SS...46..473S
1998, May 21	<i>U.S. Congressional Hearing on NEOs and Planetary Defense.</i> Statement by Carl Pilcher, Science Director, Solar System Exploration, Office of Space Science, NASA, announcing the Spaceguard Goal to the U.S. House Subcommittee on Space & Aeronautics, i.e., find and track 90% of NEOs with $D > 1$ km.
1998, Jun	NASA Near Earth Orbit Program Office established at NASA Jet Propulsion Laboratory (Pasadena, CA, USA), to coordinate and provide a focal point for US studies of NEOs. See: http://neo.jpl.nasa.gov/ http://impact.arc.nasa.gov/programs_office.cfm
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1998, Jun	P.A. Wiegert, K.A. Innanen, S. Mikkola, 1998, <i>Astronomical Journal</i> , 115, 2604, "The orbital evolution of Near-Earth Asteroid 3753 ." See: http://iopscience.iop.org/1538-3881/115/6/2604/fulltext/
1998, Jun 4	A.W. Harris, 1998, <i>Nature</i> , 393, 418, "Planetary science: making and braking asteroids." See: http://adsabs.harvard.edu/abs/1998Natur.393..418H
1998, Jun 4	E. Asphaug, S.J. Ostro, R.S. Hudson, D.J. Scheeres, W. Benz, 1998, <i>Nature</i> , 393, 437, "Disruption of kilometre-sized asteroids by

	energetic collisions." See: http://adsabs.harvard.edu/abs/1998Natur.393..437A
1998, Jun 8	Apollo NEA 1998 KY26 ($H = 25.5$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 2.10 LD. Minimum miss distance 2.10 LD. See: 1998 KY26 - JPL , 1998 KY26 - SSA See also: http://en.wikipedia.org/wiki/1998_KY26 Ref: - S.J. Ostro, P. Pravec, L.A.M. Benner, et al. 1999, <i>Science</i> , 285, 557, "Radar and optical observations of asteroid 1998 KY26 ." See: http://adsabs.harvard.edu/abs/1999Sci...285..557O See also: http://antwrp.gsfc.nasa.gov/apod/ap020919.html
1998, Jul	F. Langenhorst, G. Shafranovsky, V.L. Masaitis, 1998, <i>Meteoritics & Planetary Science</i> , 33, A90, "A comparative study of impact diamonds from the Popigai, Ries, Sudbury, and Lappajarvi Craters. " See: http://adsabs.harvard.edu/abs/1998M%26PSA..33R..90L
1998, Jul	V. Zappalà, A. Cellino, B.J. Gladman, et al., 1998, <i>Icarus</i> , 134, 176, "Asteroid showers on Earth after family breakup events." See: http://adsabs.harvard.edu/abs/1998M%26PSA..33R..90L
1998, Jul 4	The International Astronomical Union Executive Committee, at its 71 st meeting in Paris, on the initiative of General Secretary Johannes Andersen, issued a policy statement, which made clear that the detection and observations of NEOs to determine their orbits "is an international responsibility that requires the efforts of and support for astronomers around the world." It also stated that the IAU "coordinates this activity through the IAU Working Group on Near Earth Objects (WG-NEO) and offers the services of the Minor Planet Center , the international clearing house and data disseminator for NEO observations and research." It was emphasized that this was not a scientific policy judgment, but a policy issue related to public safety. See: https://www.iau.org/static/publications/IB83.pdf IAU Information Bulletin No.83, January 1999: 8. Policy Statement On Near Earth Object Research, Issued by the IAU Executive Committee on July 4, 1998. <i>The Solar system contains a large number of bodies ranging in size from the major planets to tiny meteorites. Research over the last several decades has revealed that all major bodies of the Solar system have suffered larger or smaller impacts of bodies ranging in</i>

	size from millimetres to kilometres, the best-known example of which is the abundance of craters on the Moon. Geological features on Earth show that impacts of significant size have occurred also on our own planet. The realization that such impacts occur at long, but presently poorly-known intervals has recently caused growing concern in the public, and in the press. Research on the minor constituents of the Solar system - the minor planets or asteroids - has formed part of astronomical research for the last two centuries. The International Astronomical Union (IAU) has acted as the international focal point for this research since the foundation of the Union in 1919, in particular through its Commission on the Positions and Motions of Minor Planets, Planets, and Satellites. As part of this function, the IAU has for over 50 years operated a Minor Planet Center (MPC), currently at the Smithsonian Astrophysical Observatory (SAO; Cambridge, Mass., USA), for the collection of data and the dissemination of information concerning minor planets and, lately, comets. When continued research showed that the orbits of several minor planets crossed that of the Earth, the IAU in 1991 appointed a Working Group on Near Earth Objects (NEO) to coordinate international studies of NEOs and develop suitable strategies for detection, follow-up, and orbit prediction. As one result of this work, the international Spaceguard Foundation was formed, and a number of observational programs for the detection of NEO's have been started. The WGNEO is also active in the development of proven algorithms for long-term NEO orbit prediction and thus for assessing the distance to which NEOs may approach Earth within the next few centuries. Currently, the number, size distribution, and orbits of individual NEOs are incompletely known from observation. Thus, the most urgent task is the detection and observation of NEO's to determine their orbits. This is an international responsibility that requires the efforts of and support for astronomers around the world. As the international organization of professional astronomers, the IAU coordinates this activity through the NEO Working Group and offers the services of the MPC for the collection and collation of new observations and computation of predictions from which follow-up observations can be made to improve our knowledge of the orbits and sizes of these objects. It is possible that, sometime in the future, these studies may lead to the prediction of an actual impact on Earth. In such a case, this information must be promptly conveyed to the governments of the world, who may be in a position to organise countermeasures (a subject outside the mandate of the IAU). On the other hand, public announcements of potential impacts without proper verification are

	clearly undesirable. The IAU has therefore charged the WGNEO, in consultation with astronomers worldwide, to draft a set of recommended procedures to be followed in case minor planets and comets are discovered that lead to predictions by the MPC of potential impacts. These procedures will conform to the following general principles: 1: All information will be openly shared with astronomers and the general public world-wide. 2: The content of public statements that might alarm the public will be subject to prior scientific peer review by the IAU. 3: The IAU Officers and appropriate authorities will be consulted before such information is released to the press. The IAU reaffirms and increases its support of the Minor Planet Center, as the international clearing-house for this research, and acknowledges the support of SAO and NASA for its operation. The IAU encourages all countries of the world to contribute to the effort of charting the NEO population and will continue to ensure that this global issue is addressed in a properly international forum.
1998, Jul 14	Anon., 1998, <i>JPL News</i>, 14 July 1998, "JPL selected for Near-Earth Object Program Office." See: https://www.jpl.nasa.gov/news/news.php?feature=5134
1998, Jul 28	Apollo NEA 2019 BZ ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 6.77 LD. Minimum miss distance 0.04 LD. See: 2019 BZ - JPL , 2019 BZ - SSA See also: 24 Jan 2000.
1998, Aug	S.J. Ostro, C. Sagan, 1998, <i>Astronomy & Geophysics</i>, 39, 22, "Cosmic collisions and galactic civilizations." See: http://adsabs.harvard.edu/abs/1998A%26G....39d..22O
1998, Aug	A.W. Harris, 1998, in: J. Andersen (ed.), <i>Proc. IAU XXIII GA Joint Discussion Interactions between Planets and Small Bodies</i>, in: <i>Highlights in Astronomy</i>, 11A, 257, "Searching for NEAs from Earth or space." See: http://adsabs.harvard.edu/abs/1998HiA....11..257H
1998, Aug	A.D. Taylor, W.G. Elford, 1998, in: J. Andersen (ed.), <i>Proc. IAU XXIII GA Joint Discussion Interactions between Planets and Small Bodies</i>, in: <i>Highlights in Astronomy</i>, 11A, 239, "Aspects of the terrestrial influx of small meteoroids."

	See: http://adsabs.harvard.edu/abs/1998HiA....11..239T
1998, Aug 23	Apollo NEA 513126 (1998 QP , $H = 21.6$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 4.62 LD. Minimum miss distance 4.62 LD. See: 1998 QP - JPL , 1998 QP- SSA See also: 22 Aug 1924 .
1998, Aug 30	Apollo NEA 2009 DM45 ($H = 21.2$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 4.43 LD. Minimum miss distance 4.42 LD. See: 2009 DM45 - JPL , 2009 DM45 - SSA
1998, Sep	Z. Ceplecha, J. Borovička, W.G. Elford, et al., 1998, <i>Space Science Reviews</i> , 84, 327, "Meteor phenomena and bodies." See: http://adsabs.harvard.edu/abs/1998SSRv...84..327C
1998, Sep	A. Morbidelli, B. Gladman, 1998, <i>Meteoritics & Planetary Science</i> , 33, 999, "Orbital and temporal distributions of meteorites originating in the asteroid belt." See: http://adsabs.harvard.edu/abs/1998M%26PS...33..999M
1998, Sep 25	R. Greenberg, 1998, <i>Science</i> , 281, 1971, "How asteroids come to Earth." See: http://adsabs.harvard.edu/abs/1998Sci...281.1971G
1998, Sep 25	F. Migliorini, P. Michel, A. Morbidelli, et al., 1998, <i>Science</i> , 281, 2022, "Origin of multi-kilometer Earth- and Mars-crossing asteroids: a quantitative simulation." See: http://adsabs.harvard.edu/abs/1998Sci...281.2022M
1998, Oct 7	C.R. Chapman, 1998, "History of the asteroid/comet impact hazard." See: http://www.boulder.swri.edu/clark/ncarhist.html
1998, Nov	R.B. Stothers, 1998, <i>Monthly Notices Royal Astronomical Society</i> , 300, 1098, "Galactic disc dark matter, terrestrial impact cratering and the law of large numbers." See: http://adsabs.harvard.edu/abs/1998MNRAS.300.1098S
1998, Nov	R.J. Whiteley, D.J. Tholen, 1998, <i>Icarus</i> , 136, 154, "A CCD search for Lagrangian asteroids of the Earth–Sun system." See: http://adsabs.harvard.edu/abs/1998Icar..136..154W
1998, Nov	J.C. Wynn, E.M. Shoemaker, 1998, <i>Scientific American</i> , 279 (5), 36, "The day the sands caught fire." See:

	http://adsabs.harvard.edu/abs/1998SciAm.279e..36W http://volcanoes.usgs.gov/jwynn/1998SciAm-Wabar.pdf
1998, Nov	Leonid meteor shower "Glowworm" , seen over Kirtland Air Force Base, Albuquerque (NM, USA). See: http://apod.nasa.gov/apod/ap000428.html
1998, Nov 1	P. Pravec, M. Wolf, L. Šarounová, 1998, <i>Icarus</i> , 136, 124, "Lightcurves of 26 Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/1998Icar..136..124P
1998, Nov 17	Leonid Fireball over Monteromano (Italy). See: http://apod.nasa.gov/apod/ap991112.html
1998, Nov 17	Leonid Fireball over Cape Canaveral (FL, USA). See: http://apod.nasa.gov/apod/ap981120.html
1998, Nov 17	Large Leonid meteor fireballs over northern New Mexico. Ref: - J. Zinn, J. Wren, R. Whitaker, et al., 1999, <i>Meteoritics & Planetary Science</i> , 34, 1007, "Coordinated observations of two large Leonid meteor fireballs over northern New Mexico, and computer model comparisons." See: http://adsabs.harvard.edu/abs/1999M%26PS...34.1007Z
1998, Nov 25	E. Pierazzo, D.A. Kring, H.J. Melosh, 1998, <i>Journal of Geophysical Research, Planets</i> , 103, 28607, "Hydrocode simulation of the Chicxulub impact event and the production of climatically active gases." See: http://onlinelibrary.wiley.com/doi/10.1029/98JE02496/abstract
1998, Dec	E.M. Shoemaker, 1998, <i>Journal of the Royal Astronomical Society of Canada</i> , 92, 297, "Impact cratering through geologic time." See: http://adsabs.harvard.edu/abs/1998JRASC..92..297S
1998, Dec 23	NASA spacecraft Near Earth Asteroid Rendezvous – Shoemaker (NEAR – Shoemaker) arrives at Amor NEA 433 Eros (1898 DQ) , $H = 11.16$ mag, $D = 34.4 \times 11.2 \times 11.2$ km, orbital period $P = 1.76$ yr, Amor asteroid). See: 1898 DQ- JPL , 433 Eros - SSA See also: http://near.jhuapl.edu/media/NEAR_fact_sheet.pdf http://www.scientificamerican.com/article.cfm?id=come-closer-my-near http://en.wikipedia.org/wiki/433_Eros
1999, Jan 1	650 NEAs known, of which 166 PHAs . See: http://neo.jpl.nasa.gov/stats/

1999	The 10,000th minor planet was numbered at the IAU Minor Planet Center: Main-belt asteroid 10000 Myriostos (1951 SY, $H = 15.1$ mag, $D \approx 3000$ m), discovered by Albert G. Wilson at Palomar Observatory (CA, USA). See: 1951 SY - JPL , 10000 Myriostos - SSA See also: http://www.iau.org/static/publications/IB104.pdf p. 67, http://en.wikipedia.org/wiki/10000_Myriostos
1999	NASA NEO Program Office at the Jet Propulsion Laboratory (Caltech, Pasadena, CA, USA) begins partial funding of the IAU Minor Planet Center. See: http://www.minorplanetcenter.net/iau/mpc.html
1999	LINEAR adds second co-located 1m search telescope with fast read-out CCD. See: http://www.ll.mit.edu/mission/space/linear/
1999	Australian National Observatory 0.5 m telescope in Siding Spring begins follow up observations as part of the Catalina Sky Survey. See: http://www.lpl.arizona.edu/css/index.html
1999	B.O. Dressler, V.L. Sharpton (eds.), 1999, Proc., Large meteorite impacts and planetary evolution; II, <i>Geological Society of America Special Papers</i>, Vol. 339. See: http://specialpapers.gsapubs.org/content/339
1999	J.S. Lewis, 1999, <i>Comet and asteroid impact hazards on a populated Earth</i> (New York: Academic Press). See: http://en.wikipedia.org/wiki/John_S._Lewis http://adsabs.harvard.edu/abs/2000caih.book.....L
1999	H.Y. McSween, 1999, <i>Meteorites and their Parent Planets</i> (Cambridge: CUP). See: http://www.cambridge.org/us/academic/subjects/earth-and-environmental-science/planetary-science-and-astrobiology/meteorites-and-their-parent-planets-2nd-edition
1999	C.W. Poag, 1999, Chesapeake invader: <i>discovering America's giant meteorite crater</i> (Princeton: Princeton University Press, ISBN 0-691-00919-8). See: http://press.princeton.edu/titles/6765.html
1999, Jan	A. Morbidelli, 1999, <i>Celestial Mechanics and Dynamical Astronomy</i>, 73(1/4), 39, "Origin and evolution of Near Earth Asteroids."

	See: http://adsabs.harvard.edu/abs/1999CeMDA..73...39M
1999, Jan 21	Fireball over Czech Republic, recorded by the European Fireball Network . The luminous trail is measured to begin at an altitude of 81.9 kilometers and covered 71.1 kilometers in 6.7 seconds. See: http://apod.nasa.gov/apod/ap990219.html
1999, Mar	The threat from NEOs is debated in the UK House of Commons. Minister for Energy & Industry, John Battle, said that the government will consult British astronomers and other experts on ways the UK can support NEO research.
1999, Mar 5-6	Near Earth Objects Dynamic Site (NEODyS) created, as an Italian/Spanish service that provides information on NEOs, operated at the University of Pisa (Italy), with a mirror site in Valladolid (Spain). Operational since November 1999. Both the University of Pisa and JPL post their web sites for information on NEOs (close approaches, ephemerides, orbital data). The close approach monitoring efforts, CLOMON at Pisa and SENTRY at NASA-JPL were initiated later. Since early 2002 the two automated NEO close approach monitoring services, CLOMON2 (Pisa) and SENTRY (JPL), are cross-checking their monitoring results. Starting from 1 September 2011 NEODyS is sponsored by ESA, which pays a portion of the operating costs, both for the background orbit and risk computations and for the database and web interface; the rest of the cost is covered, as before, by the Department of Mathematics, University of Pisa, with the running research grants of the Celestial Mechanics Group, and by IASF-INAF (Rome), with a PRIN-INAF grant. Ref: - A. Milani, S.R. Chesley, M.E. Sansaturio, G. Tommei, G.B. Valsecchi, 2005, <i>Icarus</i> , 173, 362, "Nonlinear impact monitoring: line of variation searches for impactors." See: http://adsabs.harvard.edu/abs/2005Icar..173..362M See also: http://neo.jpl.nasa.gov/risk/ http://adsabs.harvard.edu/abs/2001DPS....33.4108C http://aas.org/archives/BAAS/v31n4/dps99/28.htm http://en.wikipedia.org/wiki/NEODyS
1999, Mar 6	Apollo NEA 474158 (1999 FA , $H = 20.9$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 4.17 LD. Minimum miss distance 4.17 LD. See: 1999 FA - JPL , 1999 FA - SSA See also: 6 Mar 1909 , 6 Mar 2143 , 7 Mar 2194 .
1999, Mar 12	Apollo NEA 2013 EC20 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.27 LD.

	[1999-01] See: 2013 EC20 - JPL , 2013 EC20 - SSA See also: 9 March 2013.
1999, Apr	D. Vokrouhlický, 1999, <i>Astronomy & Astrophysics</i>, 344, 362, "A complete linear model for the Yarkovsky thermal force on spherical asteroid fragments." See: http://adsabs.harvard.edu/abs/1999A%26A...344..362V
1999, Apr 11	Apollo NEA 138175 (2000 EE104, $H = 20.7$ mag, $D \approx 260$ m, PHA) passed Earth at a nominal miss distance of 4.72 LD. Minimum miss distance 4.72 LD. See: 2000 EE104 - JPL , 2000 EE104 - SSA See also: 10 Apr 1998.
1999, May	NASA/USAF NEO Search Program. NASA, in collaboration with the USA Air Force, is moving to implement a search program to meet the objectives of the Spaceguard Survey, as set down in the NASA Spaceguard reports of 1992 and 1995.
1999, May	In a report to the ESA Council at ministerial level, the ESA Long-Term Space Policy Committee recommended (Action 13, Threat of Cosmic Collision) that ESA be involved in NEO activities, including the study of counter measures. Ref: LSPC Report "Investing in space – the challenge for Europe", 1999, <i>ESA SP-2000</i>. See: http://www.esa.int/esapub/sp/sp2000/sp2000.pdf
1999, May	A. Poveda, M.A. Herrera, J.L. García, K. Curioka, 1999, <i>Planetary and Space Science</i>, 47, 679, "The diameter distribution of Earth-crossing asteroids." See: http://adsabs.harvard.edu/abs/1999P%26SS...47..679P
1999, May	A. Poveda, M.A. Herrera, J.L. García, A. Hernández-Alcántara, K. Curioka, 1999, <i>Planetary and Space Science</i>, 47, 715, "The expected frequency of collisions of small meteorites with cars and aircraft." See: http://adsabs.harvard.edu/abs/1999P%26SS...47..715P
1999, May 6	Aten NEA 2000 SG344 ($H = 25.1$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 1.48 LD. Minimum miss distance 1.48 LD. See: 2000 SG344 - JPL , 2000 SG344 - SSA See also: http://en.wikipedia.org/wiki/2000_SG344 Ref: - D. Morrison, C.R. Chapman, D. Steel, R.P. Binzel, 2004, in: M.J.S. Belton, et al. (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 353, "Impacts and the public:

	communicating the nature of impact hazard." See: http://adsabs.harvard.edu/abs/2004mhca.conf..353M B.G. Marsden, 2007, in: P. Bobrowsky & H. Rickman (eds.), 2007, <i>Comet/Asteroid Impacts and Human Society</i> (Berlin: Springer), p. 505, "Impact risk communication management (1998 – 2004): Has it improved?" See: http://adsabs.harvard.edu/abs/2007caih.book....B See also: 7 May 2028, 13 Sep 2072.
1999, May 10	R.P. Binzel, M. A'Hearn, C.R. Chapman, C. Chyba, A.L. Cochran, A.W. Harris, D.K. Yeomans, B.G. Marsden, R.L. Millis & D. Morrison, 1999, "<i>From the pragmatic to the fundamental: the scientific case for near-Earth object surveys.</i>" Report prepared for the Astronomy and Astrophysics Survey Committee (AASC) of the National Academy of Sciences. Quoted in: http://www.boulder.swri.edu/clark/ncar799.html
1999, May 18	P.W. Chodas, 18 May 1999, "The continuing story of asteroid 1999 AN10." See: http://neo.jpl.nasa.gov/news/news017.html
1999, May 27	Aten NEA 2010KV39 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 5.71 LD. Minimum miss distance 0.89 LD. See: 2010 KV39 -JPL , 2010 KV39 - SSA
1999, Jun	S. Isobe and Japan Spaceguard Association, 1999, <i>Advances in Space Research</i>, 23(1), 33, "Japanese 0.5 m and 1.0 m telescopes to detect space debris and near-earth asteroids." See: http://adsabs.harvard.edu/abs/1999AdSpR..23...33I
1999, Jun	A. Milani, S.R. Chesley, G.B. Valsecchi, 1999, <i>Astronomy & Astrophysics</i> (Letters), 346, L65, "Close approaches of asteroid 1999 AN10: resonant and non-resonant returns." See: http://adsabs.harvard.edu/abs/1999A%26A...346L..65M See also: 7 August 2027.
1999, Jun	A. Morbidelli, D. Nesvorný, 1999, <i>Icarus</i>, 139, 295, "Numerous weak resonances drive asteroids toward terrestrial planets orbits." See: http://adsabs.harvard.edu/abs/1999A%26A...346L..65M
1999, Jun	Threat from NEOs discussed in UK House of Lords. Science Minister, Lord Sainsbury, says that Britain must cooperate internationally on this topic. See: http://www.greatdreams.com/near.htm
1999, Jun 1-4	Torino Workshop on International Monitoring Programs for

	<i>Asteroid and Comet Threat (IMPACT)</i>, Torino (Italy), organized by IAU Commission 15, the Spaceguard Foundation and others, and co-sponsored by NASA, ESA, IAU, ASI, IACG, Planetary Society, Alenia. The outcome includes the "Torino Scale" (describing risk and severity of possible impact for newly discovered hazardous objects), a call for national Spaceguard centres, and a plea to finance these centers in order to facilitate international collaboration in the international Spaceguard programme. Ref: - R.P. Binzel, 2000, <i>Planetary and Space Science</i>, 48, 297, "The Torino Impact Hazard Scale." See: http://adsabs.harvard.edu/abs/2000P%26SS...48..297B See also: http://neo.jpl.nasa.gov/news/news024.html
1999, Jul	The Torino Impact Hazard Scale announced simultaneously by the IAU and by NASA. Ref: - D. Morrison, C.R. Chapman, D. Steel, R.P. Binzel, 2004, in: M.J.S. Belton, et al. (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 353, "Impacts and the public: communicating the nature of impact hazard." See: http://adsabs.harvard.edu/abs/2004mhca.conf..353M http://neo.jpl.nasa.gov/torino_scale.html
1999, Jul	The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), Vienna, Austria), held a workshop on NEOs and made recommendations to the UN General Assembly. Resolution 1 adopted by the Conference, the <i>Vienna Declaration on Space and Human Development</i>, declares a strategy including actions that should be taken to: improve knowledge of NEOs; improve international coordination of activities related to NEOs; harmonize worldwide effort directed to identification, follow-up observations and orbit prediction; and research safety measures on the use of nuclear power sources in outer space. The Vienna Declaration stated that: – That the United Nations take the initiative of inviting all Member States to support near-Earth object research in their own countries, through the establishment of national or regional “spaceguard” centres to be coordinated by the international Spaceguard Foundation; – That every effort be made to provide financial support for near-Earth object research, both theoretical and observational (from ground and space), ... – The United Nations support and promote greater involvement of

	scientists and observatories from nations in the southern hemisphere, ... This <i>Vienna Declaration</i> was endorsed by the UN General Assembly in December 1999. In 2001, in response to recommendation 14 of UNISPACE III, Action Team 14 on NEOs was established by UN-COPUOS with terms of reference: (a) review the content, structure and organization of on-going efforts in the field of NEOs; (b) identify any gaps in the on-going work where additional cooperation is required and/or where other countries or organizations could make contributions; and (c) propose steps for the improvement of international coordination in collaboration with specialized bodies. See: http://www.oosa.unvienna.org/oosa/unisp-3/index.html http://www.un.org/events/unispace3/bginfo/events.htm
1999, Jul	Start of the Arcetri NEO Precovery Program (ANEOPP). Ref: - A. Boattini, G. D'Abramo, G. Forti, R. Gal, 2001, <i>Astronomy & Astrophysics</i>, 375, 293, "The Arcetri NEO Precovery Program." See: http://adsabs.harvard.edu/abs/2001A%26A...375..293B - A. Boattini, G. D'Abramo, G. Forti, 2003, <i>Memorie della Società Astronomica Italiana</i>, 74, 864, "The importance of Near Earth Object detections on archival images: recent results and future potential." See: http://adsabs.harvard.edu/abs/2003MmSAI..74..864B
1999, Jul	W.K. Hartmann, P. Farinella, D. Vokrouhlický, 1999, <i>Meteoritics & Planetary Science</i>, 34, A161, "Reviewing the Yarkovsky effect: new light on the delivery of stone and iron meteorites from the asteroid belt." See: http://adsabs.harvard.edu/abs/1999A%26A...347..711M
1999, Jul	P. Michel, R. Gonczi, P. Farinella, 1999, <i>Astronomy & Astrophysics</i>, 347, 711, "Dynamical evolution of 1036 Ganymed, the largest near-Earth asteroid." See: http://adsabs.harvard.edu/abs/1999M%26PSA..34..161H
1999, Jul 26-30	International conference on Asteroids, Comets, Meteors, VII, Cornell University, Ithaca (NY, USA).
1999, Jul 29	NASA spacecraft Deep Space 1 (1998 – 2001) flew by 9969 Braille (1992 KD, $H = 15.9$ mag, $D \approx 2200$ m, Mars-crossing asteroid) at a distance of 26 km. See: 1992 KD - JPL , 9969 Braille - SSA Ref: - B.J. Buratti, D.T. Britt, L.A. Soderblom, et al., 2004, <i>Icarus</i>, 167, 129, "9969 Braille: Deep Space 1 infrared spectroscopy, geometric albedo and classification."

	See: http://adsabs.harvard.edu/abs/2004Icar..167..129B See also: http://antwarp.gsfc.nasa.gov/apod/ap990805.html http://en.wikipedia.org/wiki/9969_Braille
1999, Aug 15-19	1999 AAS/AIAA Astrodynamics Specialist Conference, Girdwood, Alaska (USA). See: http://www.space-flight.org/AAS_meetings/1999_astro/1999_astro.html
1999, Aug 15	P.W. Chodas, D.K. Yeomans, 1999, presented at the <i>1999 AAS/AIAA Astrodynamics Specialist Conference</i>, Girdwood, Alaska (USA), 15-19 August 1999, p. 2531, "Predicting close approaches and estimating impact probabilities for Near-Earth Objects." See: http://www.space-flight.org/AAS_meetings/1999_astro/1999_astro.html
1999, Aug 19	C.R. Chapman, 1999, case study for <i>Workshop on prediction in the Earth sciences: use and misuse in policy making</i>, 10-12 July 1997, National Center for Atmospheric Research, Boulder (CO, USA) and 10-12 September 1998, Estes Park (CO, USA), "The asteroid/comet impact hazard." See: http://www.boulder.swri.edu/clark/ncar799.html
1999, Sep	A. Boattini, G. D'Abramo, G.B. Valsecchi, 1999, <i>Bulletin American Astronomical Society</i>, 31, 1117, #28.07, "NEO follow-up coordination using the Spaceguard Central Node: priority list and opportunities." See: http://adsabs.harvard.edu/abs/1999BAAS...31.1117B
1999, Sep	Start of UAO – DLR Asteroid Survey (UDAS), a collaboration between the Uppsala Astronomical Observatory (UOA, 1 m Schmidt, Uppsala, Sweden) and the Deutschen Zentrum für Luft- und Raumfahrt (DLR, the German Aerospace Center, Berlin, Germany). From 1999 to 2011 a number of 215 asteroids have been detected. See: http://earn.dlr.de/udas http://en.wikipedia.org/wiki/UAO-DLR_Asteroid_Survey
1999, Sep 10	J.G. Hills, M.P. Goda, 1999, <i>Physica D: Nonlinear Phenomena</i>, 133, 189, "Damage from comet-asteroid impacts with Earth." See: http://adsabs.harvard.edu/abs/1999PhyD..133..189H
1999, Sep 22	Apollo NEA 101955 (1999 RQ36, Bennu, $H = 20.4$ mag, $D = 484$ m, PHA) passed Earth at 5.716 LD. Minimum miss distance 5.716 LD. See: 1999 RQ36 - JPL , 101955 Bennu - SSA

	Ref: - S.R. Chesley, M.C. Nolan, D. Farnocchia, et al., May 2012, in: <i>American Astronomical Society, DDA meeting #43</i>, #7.08, "The trajectory dynamics of Near-Earth Asteroid 101955 (1999 RQ36)." See: http://adsabs.harvard.edu/abs/2012DDA....43.0708C See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2012-145 http://en.wikipedia.org/wiki/1999_RQ36 See also: 23 Sep 2060, 25 Sep 2135.
1999, Oct	T. Gehrels, E. Echternach, 1999, <i>Zenit</i>, 26(10), 416, "Mooi, maar gevaarlijk: de dodelijke schoonheid van kometen en planetoiden." See: http://adsabs.harvard.edu/abs/1999Zenit..26..416G
1999, Oct	C. de Jager, 1999, <i>Zenit</i>, 26(10), 427, "Periodieke inslagen op aarde?" See: http://www.dekoepel.nl/zenit/inslagen.html http://adsabs.harvard.edu/abs/1999Zenit..26..427D
1999, Oct 7	J.S. Lewis, 1999, <i>Comet and asteroid impact hazards on a populated earth: computer modeling</i> (Waltham: Academic Press). See: http://en.wikipedia.org/wiki/John_S._Lewis
1999, Oct 11	S. Isobe, 1999, <i>Advances in Space Research</i>, 23(11), 1861, "Proposed lunar-based telescopes for NEO observations." See: http://adsabs.harvard.edu/abs/1999AdSpR..23.1861I
1999, Nov	E. Asphaug, 1999, <i>Nature</i>, 402, 127, "Survival of the weakest." See: http://adsabs.harvard.edu/abs/1999Natur.402..127A
1999, Nov	W. Benz, E. Asphaug, <i>Icarus</i>, 142, 5, "Catastrophic disruptions revisited." See: http://adsabs.harvard.edu/abs/1999Icar..142....5B
1999, Nov	T. Gehrels, 1999, <i>Earth, Planets and Space</i>, 51, 1155, "A review of comet and asteroid statistics." See: http://adsabs.harvard.edu/abs/1999EP%26S...51.1155G
1999, Nov 7-20	First-ever radar images of a Main-belt asteroid: 216 Kleopatra ($H = 7.20$ mag, $D = 270 \times 94 \times 81$ km) obtained with the 305 m Arecibo radio telescope by Steven J. Ostro (1946 – 2008) of NASA JPL, Pasadena (CA, USA). Shape: dog bone. At the time of observation the distance to 216 Kleopatra was $d = 171 \times 10^6$ km. As of May 2008, Ostro and his collaborators had detected 222 NEAs (including 130 PHAs and 24 binaries) and 118 main belt objects with radar. See: 216 Kleopatra - JPL , 216 Kleopatra - SSA

	Ref: - S.J. Ostro, R.S. Hudson, M.C. Nolan, et al., 5 May 2000, <i>Science</i>, 288, 836, "Radar observations of asteroid 216 Kleopatra." See: http://adsabs.harvard.edu/abs/2000Sci...288..836O - P. Descamps, F. Marchis, J. Berthier, et al., 2011, <i>Icarus</i>, 211, 1022, "Triplicity and physical characteristics of asteroid (216) Kleopatra." See: http://adsabs.harvard.edu/abs/2011Icar..211.1022D - T. Chanut, O.C. Winter, October 2012, American Astronomical Society, DPS meeting #44, #210.15, "Evaluation of the gravity field and the dynamic environment of asteroid 216 Kleopatra." See: http://adsabs.harvard.edu/abs/2012DPS....4421015C See also: http://newscenter.berkeley.edu/2011/02/22/how-kleopatra-got-its-moons/ http://www.planetary.org/blog/article/00002926/ http://www.space.com/11836-asteroid-kleopatra-moons-rubble-pile.html http://en.wikipedia.org/wiki/216_Kleopatra
1999, Nov 11	E. Asphaug, 1999, <i>Nature</i>, 402, 127, "Survival of the weakest." See: http://www.nature.com/nature/journal/v402/n6758/full/402127a0.html http://adsabs.harvard.edu/abs/1999Natur.402..127A
1999, Nov 18	Leonid Fireball over Dagali (Norway). See: http://apod.nasa.gov/apod/ap991202.html
1999, Dec	A.W. Harris, J.K. Davies, 1999, <i>Icarus</i>, 142, 464, "Physical characteristics of Near-Earth Asteroids from thermal infrared spectrophotometry." See: http://adsabs.harvard.edu/abs/1999Icar..142..464H
2000, Jan 1	879 NEAs known, of which 215 PHAs. See: http://neo.jpl.nasa.gov/stats/
2000	The 100,000th minor planet was numbered at the Minor Planet Center: inner Main-belt asteroid 100000 Astronautica (1982 SH1, $H = 16.8$ mag, $D \approx 1500$ m), discovered on 28 September 1982 by J. Gibson at Palomar Observatory (CA, USA). This minor planet has been named Astronautica to recognize the 50th anniversary of the beginning of the Space Age, inaugurated by the launch of the first artificial earth satellite on 4 October 1957, Sputnik. The name Astronautica is associated with this significant number, as space is defined to begin at an altitude of 100,000 meters above the Earth's surface. See: 1982 SH1 - JPL , 100000 Astronautica - SSA http://en.wikipedia.org/wiki/100000_Astronautica

2000	Bisei Spaceguard Center established in Bisei (Okayama, Japan). See: http://en.wikipedia.org/wiki/Bisei_Spaceguard_Center http://www.spaceguard.or.jp/ja/index.html
2000	A. Deutsch, V.L. Masaitis, F. Langenhorst, R.A.F. Grieve, 2000, <i>Episodes</i> 23(1), 3, " Popigai , Siberia - well preserved giant impact structure, national treasury, and world's geological heritage." See: http://en.wikipedia.org/wiki/Popigai_crater
2000	R.A.F. Grieve, 2000, <i>Annual Review of Earth and Planetary Sciences</i> , 28, 305, " Vredefort , Sudbury , Chicxulub : three of a kind?" See: http://adsabs.harvard.edu/abs/2000AREPS..28..305G
2000	D.I. Steel, 2000, <i>Target Earth</i> (Time Life 2000; Readers Digests 2001). With an afterword by Arthur C. Clarke. See: http://en.wikipedia.org/wiki/Duncan_Steel
2000, Jan	L. Jetsu, J. Pelt, 2000, <i>Astronomy & Astrophysics</i> , 353, 409, "Spurious periods in the terrestrial impact crater record." See: http://adsabs.harvard.edu/abs/2000A%26A...353..409J
2000, Jan	L. Foschini, P. Farinella, C. Froeschlé, et al., 2000, <i>Astronomy & Astrophysics</i> , 353, 797, "Long-term dynamics of bright bolides." See: http://adsabs.harvard.edu/abs/2000A%26A...353..797F
2000, Jan	D.A. Kring, 2000, <i>GSA Today</i> , 10(8), 1, "Impact events and their effects on the origin, evolution and distribution of life." See: http://www.geosociety.org/pubs/gsatoday/archive/sci0008.htm http://www.lpi.usra.edu/science/kring/cataclysm_concept.pdf
2000, Jan 1	The University of Pisa puts its NEO Close Approach Monitoring system (CLOMON) on-line.
2000, Jan 13	D.C. Jewitt, 2000, <i>Nature</i> , 403, 145, "Eyes wide shut." See: http://adsabs.harvard.edu/abs/2000Natur.403..145J http://www.nature.com/nature/journal/v403/n6766/full/403145a0.html http://www.bibliotecapleyades.net/ciencia/ciencia_nemesis09.htm
2000, Jan 13	D. Rabinowitz, E. Helin, K. Lawrence, S. Pravdo, 2000, <i>Nature</i> , 403, 165, "A reduced estimate of the number of kilometre-sized near-Earth asteroids". See: http://adsabs.harvard.edu/abs/2000Natur.403..165R

2000, Jan 18	The Tagish Lake Meteorite exploded in the upper atmosphere at an estimated altitude of ~ 40 km with an energy of 1.7 kT TNT over Tagish Lake (Yukon Territory and northern British Columbia, Canada). A fireball was observed and over 500 fragments of meteorite collected. The Tagish Lake meteoroid is estimated to have been of $D \approx 4.5$ m in diameter and $M \approx 75$ tons in weight before it entered the Earth's atmosphere. It is estimated that only 1.3 tons remained after ablation in the upper atmosphere and several fragmentation events, meaning that around 97% of the meteorite had vaporized. Of these 1.3 tons of fragmented rock, only 0.1% was found and collected. Studies of the reflectance spectrum of the meteorite indicate that it likely originated from 773 Irmintraud, a D-type main-belt asteroid. Ref: - T. Hiroi, M.E. Zolensky, C.E. Pieters, 2001, <i>Science</i>, 293, 2234, "The Tagish Lake Meteorite: a possible sample from a D-type asteroid." See: http://adsabs.harvard.edu/abs/2001Sci...293.2234H - A.R. Hildebrand, P.J.A. McCausland, P.G. Brown, et al., 2006, <i>Meteoritics & Planetary Science</i>, 41, 407, "The fall and recovery of the Tagish Lake Meteorite." See: http://adsabs.harvard.edu/abs/2006M%26PS...41..407H - C.D.K. Herd, A. Blinova, D. Simkus, 201, <i>Science</i>, 332, 1304, "Origin and evolution of prebiotic organic matter as inferred from the Tagish Lake Meteorite." See: http://www.sciencemag.org/content/332/6035/1304.abstract?sid=22a6dae6-2ea2-4c33-a0a6-5937339f249b See also: http://www.scientificamerican.com/article.cfm?id=ancient-meteorites-from-o
2000, Jan 23	NASA/ESA spacecraft Cassini/Huygens took pictures of Main-belt asteroid 2685 Masursky (1981 JN, $H = 12.1$, $D = 13$ km). See: 1981 JN - JPL , 2685 Masursky - SSA See also: http://ciclops.org/view/76/Masursky_Flyby?js=1 http://uanews.org/node/2841 http://www.nasa.gov/pdf/474203main_Coradini_ExploreNOW.pdf https://en.wikipedia.org/wiki/2685_Masursky
2000, Jan 24	Apollo NEA 2019 BZ ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 5.60 LD. Minimum miss distance 0.53 LD. See: 2019 BZ - JPL , 2019 BZ - SSA See also: 28 Jul 1998.
2000, Feb	The Japanese Spaceguard Association (JSGA) starts operations at

	Bisei Spaceguard Center (0.5 m and 1.0 m telescopes), Bisei (Japan). Ref: - M. Yoshikawa, A. Asami, D. Asher, et al., 2002, <i>Memorie della Società Astronomica Italiana</i>, 73, 772, "Current status of asteroid observations in Bisei Spaceguard Center." See: http://adsabs.harvard.edu/abs/2002MmSAI..73..772Y
2000, Feb	P. Michel, V. Zappalà, A. Cellino, P. Tanga, 2000, <i>Icarus</i>, 143, 42, "Estimated abundance of Atens and asteroids evolving on orbits between Earth and Sun." This paper defines the Inner-Earth Objects (IEOs). See: http://adsabs.harvard.edu/abs/2000Icar..143..421M
2000, Feb	C.R. Chapman, 2000, in: D. Sarewitz, R.A. Pielke, R. Byerly (eds.), <i>Prediction: Science, Decision Making, and the Future of Nature</i> (Washington DC: Island Press), p. 107, "The asteroid/comet impact hazard: homo sapiens as dinosaur?" See: http://www.boulder.swri.edu/clark/ncar799.html
2000, Mar	Between August 1972 and March 2000, the US Air Force Early Warning Satellites sensors detected 518 impact events (~30 events per year) in the > 1kT TNT class, i.e. impacts of objects with $D \approx$ few meters. Most of these events were primarily bursts in the upper atmosphere and were not detected at ground level.
2000, Mar	D.W. Dunham, B. Cudnik, D.M. Palmer, et al., 2000, in: <i>31st Annual Lunar and Planetary Science Conference</i>, March 13-17, 2000, Houston (Texas, USA), abstract no. 1547, "The first confirmed video recordings of lunar meteor impacts." See: http://adsabs.harvard.edu/abs/2000LPI....31.1547D
2000, Mar	D.P. Rubincam, W.F. Bottke, 2000, in: <i>31st Annual Lunar and Planetary Science Conference</i>, 13-17 March 2000, Houston (TX, USA), Abstract no. 1399, "The YORP effect and the spin of small asteroids." YORP stands for Yarkovsky-O'Keefe-Radzievskii-Paddack. Ref: - V.V. Radzievskii, 1952, <i>Astron. Zh.</i>, 29, 162, "A mechanism for the disintegration of asteroids and meteorites." See: http://adsabs.harvard.edu/abs/1952AZh....29..162R - S.J. Paddack, 1969, <i>Journal Geophysical Research</i>, 74, 4379, "Rotational burning of small celestial bodies: effects of radiation pressure." See: http://adsabs.harvard.edu/abs/1969JGR...74.4379P - J.A. O'Keefe, 1976, <i>Tektites and their origin</i>, (Amsterdam:

	Elsevier). See: http://adsabs.harvard.edu/abs/1976tto..book....O - V.V. Sazonov, 1994, <i>Solar System Research</i>, 28, 152, "Motion of an asteroid about its center of mass due to torque from light pressure." See: http://adsabs.harvard.edu/abs/1994SoSyR..28..152S See also: http://www.lpi.usra.edu/meetings/lpsc2000/pdf/1399.pdf
2000, Apr	R.P. Binzel, 2000, <i>Planetary and Space Science</i>, 48, 297, "The Torino Impact Hazard Scale." See: http://adsabs.harvard.edu/abs/2000P%26SS...48..297B
2000, Apr 15	A.J. Mory, R.P. Iasky, A.Y. Glikson, F. Pirajno, 2000, <i>Earth and Planetary Science Letters</i>, 177, 119, "Woodleigh, Carnarvon Basin, Western Australia: a new 120 km diameter impact structure." See: https://ui.adsabs.harvard.edu/abs/2000E%26PSL.177..119M/abstract See also: http://www.dmp.wa.gov.au/Meteorite-impacts-craters-1642.aspx
2000, Apr 20	D.K. Yeomans, 2000, <i>Nature</i>, 404, 829, "Small bodies of the Solar System." See: http://adsabs.harvard.edu/abs/2000Natur.404..829Y
2000, May	E. Asphaug, 2000, <i>Scientific American</i>, 282, 46, "The small planets." See: http://www.nature.com/scientificamerican/journal/v282/n5/pdf/scientificamerican0500-46.pdf
2000, May	A. Milani, S.R. Chesley, A. Boattini, G.B. Valsecchi, 2000, <i>Icarus</i>, 145, 12, "Virtual impactors: search and destroy." See: http://adsabs.harvard.edu/abs/2000Icar..145...12M
2000, May	S.N. Ward, E. Asphaug, 2000, <i>Icarus</i>, 145, 64, "Asteroid impact tsunamis: a probabilistic hazard assessment." See: http://adsabs.harvard.edu/abs/2000Icar..145...64W
2000, May 6	Morávka (Czech Republic) Meteorite Fall. Occurred on May 6, 2000, 11:52 UT, during the daytime. Six H56 ordinary chondrites with a total mass of 1.4 kg were recovered. The corresponding fireball was witnessed by thousands of people and video-taped by three casual witnesses. Sonic booms were recorded by 16 seismic stations in the Czech Republic and Poland and by one infrasonic station in Germany. See: https://www.lpi.usra.edu/meteor/metbull.php?code=16742 Ref: - J. Borovička, P. Spurný, P. Kalenda, E. Tagliaferri, 2003,

	<i>Meteoritics & Planetary Science</i>, 38, 975, "The Morávka meteorite fall. 1. Description of the events and determination of the fireball trajectory and orbit from video records." See: http://adsabs.harvard.edu/abs/2003M%26PS...38..975B
2000, May 16	"Near-Earth Object meeting has quite an impact." Representatives of ESA and other European organizations gathered in Paris to discuss the threat from Near-Earth Objects (NEOs). Non-ESA participants included the General Secretary of the International Astronomical Union (IAU), delegates from several ESA member states, experts from a number of astronomical observatories including the European Southern Observatory (ESO), and a representative from the European Community. The purpose of the meeting was to define a European strategy for the protection of the planet from Near-Earth Objects – asteroids and comets which pass close to the Earth's orbit. See: http://astronomy.2009.esa.int/science-e/www/object/index.cfm?fobjectid=19110
2000, Jun	W.F. Bottke, D.P. Rubincam, J.A. Burns, 2000, <i>Icarus</i>, 145, 301, "Dynamical evolution of main belt meteoroids: numerical simulations incorporating planetary perturbations and Yarkovsky thermal forces." See: http://adsabs.harvard.edu/abs/2000Icar..145..301B
2000, Jun	P. Michel, F. Migliorini, A. Morbidelli, V. Zappalà, 2000, <i>Icarus</i>, 145, 332, "The population of Mars-crossers: classification and dynamical evolution." See: http://adsabs.harvard.edu/abs/2000Icar..145..332M
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2000, Jul	M.V. Sykes, R.M. Cutri, J.W. Fowler, et al., 2000, <i>Icarus</i>, 146, 161, "The 2MASS asteroid and comet survey." See: http://adsabs.harvard.edu/abs/2000Icar..146..161S
2000, Jul	B. Gladman, P. Michel, C. Froeschlé, 2000, <i>Icarus</i>, 146, 176, "The Near-Earth Object population." See: http://adsabs.harvard.edu/abs/2000Icar..146..176G
2000, Jul 9-12	<i>International conference on Catastrophic Events & Mass Extinctions: Impacts and Beyond</i>, 9-12 Jul 2000, Vienna (Austria). Proceedings: C. Koeberl & K.G. MacLeod (eds.), 2002, <i>Geological</i>

	<i>Society of America Special Papers</i>, Vol. 356, "Catastrophic events and mass extinctions: impacts and beyond." See: http://specialpapers.gsapubs.org/content/356 See: http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=2001ceme.conf.3142O&db_key=AST
2000, Jul 16	V. Garshnek, D. Morrison, F.M. Burkle, 2000, <i>Space Policy</i>, 16, 213, "The mitigation, management, and survivability of asteroid/comet impact with Earth." See: http://adsabs.harvard.edu/abs/2000SpPol..16..213G
2000, Jul 28	A. Cellino, M. Di Martino, E. Dotto, et al., 2000, <i>Proc. SPIE</i>, 4013, 433, "Spaceguard-1: a space-based observatory for NEO physical characterization and discovery." See: http://adsabs.harvard.edu/abs/2000SPIE.4013..433C
2000, Aug	A. Milani, S.R. Chesley, G.B. Valsecchi, 2000, <i>Planetary and Space Science</i>, 48, 945, "Asteroid close encounters with Earth: risk assessment." See: http://adsabs.harvard.edu/abs/2000P%26SS...48..945M
2000, Aug	D. Morrison, 2000, <i>Physics Today</i>, 53, no. 8, p. 14, "Moon yields info on near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2000PhT....53h..14M
2000, Aug	B. Schwarzschild, 2000, <i>Physics Today</i>, 53, no. 8, p. 21, "Survey halves estimated population of big Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/2000PhT....53c..21S
2000, Aug	E.F. Tedesco, K. Muinonen, S.D. Price, 2000, <i>Planetary and Space Science</i>, 48, 801, "Space-based infrared near-Earth asteroid survey simulation." See: http://adsabs.harvard.edu/abs/2000P%26SS...48..801T
2000, Aug	J. Tichá, M. Tichý, Z. Moravec, 2000, <i>Planetary and Space Science</i>, 48, 787, "Klet' Observatory NEO follow-up programme." See: http://adsabs.harvard.edu/abs/2000P%26SS...48..787T
2000, Aug	J. Tichá, M. Tichý, Z. Moravec, 2000, <i>Planetary and Space Science</i>, 48, 955, "The importance of follow-up observations for newly discovered NEOs." See: http://adsabs.harvard.edu/abs/2000P%26SS...48..955T
2000, Aug 1	The Spaceguard Survey, which has the objective of finding 90% of the NEAs with $D > 1$ km (defined as brighter than absolute magnitude $H = 18$) by 2009, is now approximately half complete (by number of objects, not by time required). Through the end of June

	2000, 410 of these larger NEAs have been discovered.
2000, Aug 14	IAU XXIV General Assembly, Manchester (UK). Division III Working Group on Near-Earth Objects (WG-NEO) meeting. Report by David Morrison, chair of the WG. Ref: - H. Rickman (ed.), 2001, IAU WG-NEO Report, <i>Transactions IAU XXIVB</i>, (San Francisco: ASP), p. 139, "Working Group on Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2001IAUTB..24.....R
2000, Aug 16	H. Atkinson, C. Tickell & D. Williams (eds.), 2000, Report of the UK Task Force on Potentially Hazardous Near Earth Objects, presented to the DG of the British National Space Center (BNSC), published 18 September 2000. As a result, BNSC created a NEO Information Center in Leicester (UK). See: http://impact.arc.nasa.gov/gov_UK_neotask.cfm Ref: - I.P. Williams, 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), <i>Proc. IAU Symp. No. 236 on Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i>, Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 471, "The UK Near Earth Objects Information Centre (NEOIC)." See: http://adsabs.harvard.edu/abs/2007IAUS..236..471W See also: http://www.greatdreams.com/near.htm
2000, Sep	D.W. Hughes, 2000, <i>Monthly Notices of the Royal Astronomical Society</i>, 317, 429, "A new approach to the calculation of the cratering rate of the Earth over the last 125 ± 20 Myr." See: http://adsabs.harvard.edu/abs/2000MNRAS.317..429H
2000, Sep 11-15	3rd International Conference on Space Protection of the Earth (SPE-2000) , Evpatoria (Ukraine).
2000, Sep 22	R.P. Binzel, 2000, <i>Science</i>, 289, 2065, "Asteroids come of age." See: http://www.sciencemag.org/content/289/5487/2065.summary?sid=07315ef2-c90b-4465-839a-dc2946cc0fbc
2000, Oct	D. Vokrouhlický, A. Milani, 2000, <i>Astronomy & Astrophysics</i>, 362, 746, "Direct solar radiation pressure on the orbits of small near-Earth asteroids: observable effects?" See: http://adsabs.harvard.edu/abs/2000A%26A...362..746V
2000, Oct 5	D. Vokrouhlický, P. Farinella, 2000, <i>Nature</i>, 407, 606, "Efficient delivery of meteorites to the Earth from a wide range of asteroid parent bodies." See: http://adsabs.harvard.edu/abs/2000Natur.407..606V

2000, Oct 10	Apollo NEA 2020 GB1 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 2.79 LD. Minimum miss distance 0.02 LD. See: 2020 GB1 – S2P , 2020 GB1 – JPL See also: 7 Apr 2035 .
2000, Oct 31	Apollo NEA 4179 Toutatis (1989 AC , $H = 15.2$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, orbital $P = 4.03$ yr, PHA) passed Earth at 28.7 LD. It is the largest known PHA . See: 1989 AC - JPL , 4179 Toutatis - SSA http://en.wikipedia.org/wiki/4179_Toutatis Ref: - R.S. Hudson, S.J. Ostro, D.J. Scheeres, 2003, <i>Icarus</i> , 161, 346, "High-resolution model of asteroid 4179 Toutatis ." See: http://adsabs.harvard.edu/abs/2003Icar..161..346H See also: http://science.nasa.gov/science-news/science-at-nasa/2000/ast31oct_1/ See also: 8 Dec 1992 , 30 Nov 1996 , 29 Sep 2004 , 9 Nov 2008 , 12 Dec 2012 , 5 Nov 2069 .
2000, Nov	R.S. Hudson, S.J. Ostro, R.F. Jurgens, et al., 2000, <i>Icarus</i> , 148, 37, "Radar observations and physical model of asteroid 6489 Golevka ." See: http://adsabs.harvard.edu/abs/2000Icar..148...37H 6489 Golevka , 1991 JX , $H = 18.9$ mag, $D \approx 350 \times 250 \times 250$ m, Apollo NEA, PHA . See: 1991 JX - JPL , 6489 Golevka - SSA
2000, Nov	P. Pravec, A.W. Harris, 2000, <i>Icarus</i> , 148, 12, "Fast and slow rotating asteroids." See: http://adsabs.harvard.edu/abs/2000Icar..148...12P
2000, Nov	D.P. Rubincam, 2000, <i>Icarus</i> , 148, 2, "Radiative spin-up and spin-down of small asteroids." See: http://adsabs.harvard.edu/abs/2000Icar..148....2R
2000, Nov	J. Tate, 2000, <i>Space Policy</i> , 16(4), 261, "Avoiding collisions: the Spaceguard Foundation ." See: https://ui.adsabs.harvard.edu/abs/2000SpPol..16..261T/abstract
2000, Nov	D. Vokrouhlický, A. Milani, S.R. Chesley, 2000, <i>Icarus</i> , 148, 118, "Yarkovsky effect on small Near-Earth Asteroids: mathematical formulation and examples." See: http://adsabs.harvard.edu/abs/2000Icar..148..118V
2001 , Jan 1	1241 NEAs known, of which 291 PHAs . See: http://neo.jpl.nasa.gov/stats/

2001	The CINEOS program (Campo Imperatore Near Earth Object Survey), which started in 2001, is dedicated to the discovery and follow-up of Near Earth Objects with a 90-cm Schmidt telescope. Between October 2001 and November 2004 CINEOS measured more than 6,1000 asteroid positions and discovered almost 2,200 new objects, including six NEOs and one Centaur (planetoid). Ref: - F. Bernardi, A. Boattini, G. D'Abramo, 2002, in B. Warmbein (ed.), 2002, <i>Proc. Asteroids, Comets, Meteors - ACM 2002</i>, 29 July - 2 August 2002, Berlin (Germany), ESA SP-500, p. 801, "The Campo Imperatore Near Earth Objects Survey (CINEOS)." See: http://adsabs.harvard.edu/abs/2002ESASP.500.....W - A. Boattini, G. D'Abramo, G.B. Valsecchi, et al., 2007, <i>Earth, Moon and Planet</i>, 100, 259, "The Campo Imperatore Near Earth Objects Survey (CINEOS)." See: http://adsabs.harvard.edu/abs/2007EM%26P..100..259B See also: http://en.wikipedia.org/wiki/Campo_Imperatore_Near-Earth_Object_Survey
2001	Steps towards a NEO survey program in the southern hemisphere: Búsqueda Uruguay de Supernovas, Cometas y Asteroides (BUSCA), in cooperation with the South American Spaceguard Association, with telescopes in Argentina, Brazil, Paraguay and Uruguay. A new 46-cm telescope of the Observatorio Astronómico Los Molinos (Uruguay) is expected to be operational in early 2002. Ref: - G. Tancredi, A. Sosa, E. Acosta, et al. 2004, in: W. Wamsteker, R. Albrecht, H. Haubold (eds.), <i>Developing Basic Space Science World-Wide. A Decade of UN/ESA Workshops</i> (Dordrecht: Kluwer), p. 137, "The Uruguayan automated and robotic telescope BUSCA." See: http://adsabs.harvard.edu/abs/2004dbss.book..137T See also: http://oalm.astronomia.edu.uy/proyectos/busca/NEOSurvey.htm
2001	A.W. Harris, 2001, in: M. Marov, H. Rickman (eds.), <i>Collisional processes in the Solar System</i> (Dordrecht: Kluwer), p. 323, "Near-Earth Asteroid surveys." See: http://adsabs.harvard.edu/abs/2001ASSL..261..323H
2001	S. Isobe, 2001, <i>Advances in Space Research</i>, 28, 1139, "Short warning time for an NEA collision." See: http://adsabs.harvard.edu/abs/2001AdSpR..28.1139I
2001	C. Koeberl, 2001, <i>Earth, Moon and Planets</i>, 85-86, 209, "Craters on the Moon from Galileo to Wegener: a short history of the impact hypothesis, and implications for the study of terrestrial impact craters." See: http://adsabs.harvard.edu/abs/2001EM%26P...85..209K

2001	M. Marov, H. Rickman (eds.), 2001, <i>Collisional processes in the Solar System</i> (Dordrecht: Kluwer). See: http://adsabs.harvard.edu/abs/2001ASSL..261.....M
2001	S.D. Price, M.P. Egan, 2001, <i>Advances in Space Research</i> , 28, 1117, "Spaced based infrared detection and characterization of Near Earth Objects." See: http://adsabs.harvard.edu/abs/2001AdSpR..28.1117P
2001	A. Morbidelli, 2001, in: M. Marov, H. Rickman (eds.), <i>Collisional processes in the Solar System</i> (Dordrecht: Kluwer), p. 289, "Origin and evolution of Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2001ASSL..261..289M
2001, Jan	A. Cellino, 2001, <i>Advances in Space Research</i> , 28, 1103, "Physical properties of near-earth objects: open problems." See: http://adsabs.harvard.edu/abs/2001AdSpR..28.1103C
2001, Jan 1	Spaceguard Survey update, ~50% of asteroids with $D > 1$ km discovered.
2001, Jan 15	Aten NEA 2001 BA16 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.79 LD. [2001-01] See: 2001 BA16 - JPL , 2001 BA16 - SSA See also: 17 Jan 1960 .
2001, Jan 18	Perseid Meteor Shower recorded at Wise Observatory (Israel). See: http://apod.nasa.gov/apod/ap050812.html
2001, Jan 19	NEO - MIPA Near-Earth Object hazard mitigation publication analysis , performed for ESA-ESOC. See: http://www.tu-dresden.de/mwlr/space/rfs/Dokumente/Publikationen/NEO-MIPA-report.pdf
2001, Feb	Asiago DLR Asteroid Survey (ADAS) began observations at Asiago-CimaEkar, a joint venture between the Department of Astronomy of the University of Asiago (Italy), the Astronomical Observatory of Padua (Italy), and the DLR Institute of Space Sensor Technology and Planetary Exploration, Berlin-Adlershof (Germany). The system uses a 2K x 2K CCD detector and a 0.6 m aperture Schmidt telescope. 108 asteroids discovered in 2001 – 2002. See: http://dipastro.pd.astro.it/planets/adas/ http://neo.jpl.nasa.gov/programs/adas.html

2001, Feb 12	Touch down of NASA spacecraft Near Earth Asteroid Rendezvous – Shoemaker (NEAR – Shoemaker), launched 17 February 1996, on Amor NEA 433 Eros (A898 PA), $H = 11.16$ mag, $D = 34.4 \times 11.2 \times 11.2$ km, orbital $P = 1.76$ yr) in the "saddle region." Radio contact with NEAR–Shoemaker was lost on 28 February 2001. See: 1898 DQ - JPL , 433 Eros - SSA Ref: - D.K. Yeomans, P.G. Antreasian, J.-P. Barriot, et al., 2000, <i>Science</i>, 289, 2085, "Radio science results during the NEAR-Shoemaker spacecraft rendezvous with Eros." - See: http://adsabs.harvard.edu/abs/2000Sci...289.2085Y - E. Asphaug, September 2001, <i>Nature</i>, 413, 369, "Once upon an asteroid." - See: http://adsabs.harvard.edu/abs/2001Natur.413..369A - J. Veverka, B. Farquhar, M. Robinson, et al., 2001, <i>Nature</i>, 413, 390, "The landing of the NEAR-Shoemaker spacecraft on asteroid 433 Eros." - See: http://adsabs.harvard.edu/abs/2001Natur.413..390V - J. Veverka (ed.), 2002, <i>Icarus</i>, 155, 1, "Near at Eros." - See: http://adsabs.harvard.edu/abs/2002Icar..155....1V - D.W. Dunham, R.W. Farquhar, J.V. McAdams, et al., <i>Icarus</i>, 159, 433, "Implementation of the first asteroid landing." - See: http://adsabs.harvard.edu/abs/2002Icar..159..433D - C.R. Chapman, 2004, in: M.J.S. Belton, et al. (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 104, "What we know and don't know about surfaces of potentially hazardous small bodies." - See: http://adsabs.harvard.edu/abs/2004mhca.conf..104C See also: http://near.jhuapl.edu/ http://near.jhuapl.edu/media/NEAR_fact_sheet.pdf http://nssdc.gsfc.nasa.gov/planetary/news/near_descent_pr_20010131.html http://www.scientificamerican.com/article.cfm?id=come-closer-my-near http://www.scientificamerican.com/article.cfm?id=nearing-a-crash-landing http://www.scientificamerican.com/article.cfm?id=close-encounter http://antwarp.gsfc.nasa.gov/apod/ap070217.html http://antwarp.gsfc.nasa.gov/apod/ap090607.html http://www.wired.com/wiredscience/2012/05/manned-asteroid-flyby-mission-1966/ http://en.wikipedia.org/wiki/433_Eros
2001, Feb 12	Number 1 issue of Tumbling Stone, on-line scientific magazine about NEOs, published by the Spaceguard Foundation and NEODyS. Discontinued after Number 25, 20 May 2004. See: http://spaceguard.iasf-roma.inaf.it/tumblingstone/index.html
2001, Feb 23	New asteroid survey telescope proposed: the LSST.

	See: 2021. See also: http://www.lsst.org/lsst
2001, Feb 24	C.R. Chapman, D.D. Durda, R.E. Gold, 2001, "The comet/asteroid impact hazard: a systems approach." See: http://www.internationalinspace.com/pdf/NEOwp_Chapman-Durda-Gold.pdf
2001, Feb 26	Apollo NEA 2001 EC, $H = 18.9$ mag, $D \approx 600$ m, PHA) passed Earth at a nominal miss distance of 3.83 LD. Minimum miss distance 3.83 LD. See: 2001 EC - JPL , 2001 EC - SSA
2001, Mar	A.R. Hildebrand, K.A. Carroll, D.D. Balam, et al., 2001, presented at <i>32nd Annual Lunar and Planetary Science Conference</i>, 12-16 March 2001, Houston (TX, USA), abstract no.1790, "The Near-Earth Space Surveillance (NESS) mission: discovery, tracking, and characterization of asteroids, comets, and artificial satellites with a microsatellite." See: http://adsabs.harvard.edu/abs/2001LPI....32.1790H
2001, Mar	A. Morbidelli, J.-M. Petit, B. Gladman, J. Chambers, 2001, <i>Meteoritics & Planetary Science</i>, 36, 371, "A plausible cause of the Late Heavy Bombardment." See: http://adsabs.harvard.edu/abs/2001M%26PS...36..371M
2001, Mar 5	Apollo NEA 29075 (1950 DA), $H = 17.5$ mag, $D \approx 2000$ m, PHA) passed Earth at 0.05 AU (= 20.3 LD). It will pass Earth closely on 16 March 2880. See: 1950 DA - JPL , 29075 1950 DA - SSA Ref: - J.D. Giorgini, S.J. Ostro, L.A.M. Benner, et al., 2002, <i>Science</i>, 296, 132, "Asteroid 1950 DA's encounter with Earth in 2880: physical limits of collision probability prediction." See: http://adsabs.harvard.edu/abs/2002Sci...296..132G - D. Farnocchia, S.R. Chesley, 2014, <i>Icarus</i>, 229, 321, "Assessment of the 2880 impact threat from asteroid (29075) 1950 DA." See: http://adsabs.harvard.edu/abs/2014Icar..229..321F See also: https://cneos.jpl.nasa.gov/doc/1950da/ http://en.wikipedia.org/wiki/(29075)_1950_DA See also: 16 Mar 2880.
2001, Mar 28	Apollo NEA 2012 FP35 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 9.62 LD. Minimum miss distance 0.14 LD. See: 2012 FP35 - JPL , 2012 FP35 - SSA

	See also: https://en.wikipedia.org/wiki/2012_FP35
2001, Apr	G. Neukum, B.A. Ivanov, W.K. Hartmann, 2001, <i>Space Science Reviews</i> , 96, 55, "Cratering records in the inner solar system in relation to the Lunar Reference System." See: http://link.springer.com/article/10.1023%2FA%3A1011989004263
2001, May	D.F. Lupishko, T.A. Lupishko, 2001, <i>Solar System Research</i> , 35, 227, "On the origins of Earth-approaching asteroids." See: http://adsabs.harvard.edu/abs/2001SoSyR..35..227L
2001, May 12	New evidence indicates that the Triassic-Jurassic mass extinction 200 Myr ago was sudden, consistent with possible impact mechanism. See: http://en.wikipedia.org/wiki/Triassic%E2%80%93Jurassic_extinction_event
2001, May 25	Binary Aten NEA 66391 (1999 KW4, <i>H</i> = 16.9 mag, <i>D</i> ≈ 1600 m, <i>PHA</i>) passed Earth at 12.58 LD. Minimum miss distance 12.58 LD. See: 1999 KW4 - JPL , 66391 1999 KW4 - SSA A team of astronomers studied images that show the trail of a smaller component orbiting a larger component, images made with the 70-m Goldstone radar antenna in California's Mojave Desert. The system is the third binary near-Earth asteroid pair revealed by radar, but the first system imaged over a complete orbit of one component around the other. Steven J. Ostro of NASA's Jet Propulsion Laboratory in Pasadena (CA, USA), leader of the team that made the discovery: " Goldstone was able to track the asteroid for up to eight hours daily for a week. Then we made close-up images of each component using the Arecibo telescope in Puerto Rico, which is not as fully steerable but is much more powerful." Ref: - S.J. Ostro, J.-L. Margot, L.A.M. Benner, et al., 2006, <i>Science</i> , 314, 1276, "Radar imaging of binary Near-Earth Asteroid (66391) 1999 KW4 ." See: http://adsabs.harvard.edu/abs/2006Sci...314.1276O - A.W. Harris, E.G. Fahnestock, P. Pravec, 2009, <i>Icarus</i> , 199, 310, "On the shapes and spins of “rubble pile” asteroids." See: http://adsabs.harvard.edu/abs/2009Icar..199..310H See also: http://www.planetary.org/radio/show/00000216/ http://en.wikipedia.org/wiki/66391_1999_KW4 See also: 25 May 2019, 27 May 2021.
2001, Jun	R.P. Binzel, A.W. Harris, S.J. Bus, T.H. Burbine, 2001, <i>Icarus</i> , 151,

	139, "Spectral properties of Near-Earth Objects: Palomar and IRTF results for 48 objects including spacecraft targets (9969) Braille and (10302) 1989 ML." NEOs show a greater spectral diversity than main-belt asteroids. See: http://adsabs.harvard.edu/abs/2001Icar..151..139B
2001, Jun 11-16	International meeting Asteroids 2001: From Piazzì to the 3rd Millennium (Asteroids III), Palermo (Sicily, Italy). Proceedings: W.F. Bottke, A. Cellino, P. Paolicchi & R.P. Binzel (eds.), 2002, <i>Asteroids III</i> (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/2002aste.conf.....B
2001, Jun 17-25	Workshop on Physical Properties Of Potential Earth Impactors: Know Your Enemy, Erice (Sicily, Italy). Proceedings: W.F. Huebner, J.M. Greenberg (eds.), 2002, <i>Meteoritics & Planetary Science</i>, 37, "Erice Workshop Summary on Physical and Chemical Properties of Potential Earth Impactors." See: http://adsabs.harvard.edu/abs/2002M%26PS...37.1642H http://www.ccsem.infn.it/ccsem01/Greenberg01.html
2001, Jul	G.F. Gronchi, 2001, <i>Icarus</i>, 152, 58, "Proper elements for Earth-crossing asteroids." See: http://adsabs.harvard.edu/abs/2001Icar..152..58G
2001, Jul 23	Bright meteor fireball over central Pennsylvania (USA) seen from the ground and space (by DoD satellites), tracked from an altitude of 82 km down to 32 km. Evaporated object had initial mass $M \approx 30 - 90$ ton. See: http://www.space.com/scienceastronomy/solarsystem/meteor_eastcoast_01_0725.html
2001, Aug	A. Boattini, G. D'Abramo, G. Forti, R. Gal, 2001, <i>Astronomy & Astrophysics</i>, 375, 293, "The Arcetri NEO precovery program." See: http://adsabs.harvard.edu/abs/2001A%26A...375..293B
2001, Aug	J.L. Remo, H.J. Haubold, 2001, <i>Space Policy</i>, 17, 213, "NEO scientific and policy developments, 1995–2000." See: http://adsabs.harvard.edu/abs/2001SpPol..17..213R
2001, Sep	M.C. Nolan, E. Asphaug, R. Greenberg, H.J. Melosh, 2001, <i>Icarus</i>, 153, 1, "Impacts on asteroids: fragmentation, regolith transport, and disruption." See: http://adsabs.harvard.edu/abs/2001Icar..153....1N
2001, Sep	G. D'Abramo, A.W. Harris, A. Boatini, S.C. Werner, A.W. Harris,

	G.B. Valsecchi, 2001, <i>Icarus</i> , 153, 214, "A simple probabilistic model to estimate the population of near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2001Icar..153..214D
2001, Sep 11-15	4th International Conference on Space Protection of the Earth (SPE-2001) , Evpatoriya (Ukraine).
2001, Oct	S.V. Jeffers, S.P. Manley, M.E. Bailey, D.J. Asher, 2001, <i>Monthly Notices of the Royal Astronomical Society</i> , 327, 126, "Near-Earth object velocity distributions and consequences for the Chicxulub impactor ." See: http://adsabs.harvard.edu/abs/2001MNRAS.327..126J
2001, Oct 20	B612 Foundation founding workshop on Deflecting Asteroids , NASA Johnson Space Center, Houston (TX, USA), organized by Ed Lu and Piet Hut. Named after the asteroid featuring in the novel <i>Le Petit Prince</i> (Antoine de Saint Exupéry, 1943, Paris: Editions Gallimard), B612 is a think-tank and lobby group set up by Apollo 9 astronaut Russell L. Schweickart to further the Earth's protection against asteroid strikes. See: http://www.b612foundation.org/b612 Ref: - D. Chandler, 2008, <i>Nature</i> , 453, 1164, "The burger bar that saved the world." See: http://www.nature.com/news/2008/080625/full/4531164a.html See also: http://www.b612foundation.org/about/history.html http://www.sns.ias.edu/~piet/act/geo/deflection/index.html
2001, Oct 23 – 26	International Workshop on Collaboration and Coordination among NEO Observers and Orbital Computers , Kurashiki (Okayama, Japan), organized by the Japan Spaceguard Association . Proceedings: S. Isobe & Y. Asakura (eds.), 2001. See: http://www.spaceguard.or.jp/SGFJ/ws2001/kurashiki.pdf
2001, Oct 24	Aten NEA 2010 FN ($H = 26.4$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 9.78 LD. Minimum miss distance 0.64 LD. See: 2010 FN - JPL , 2010 FN - SSA See also: 24 Mar 2074 .
2001, Nov	J.S. Stuart, 2001, <i>Science</i> , 294, 1691, "A Near-Earth Asteroid population estimate from the LINEAR Survey ." See: http://adsabs.harvard.edu/abs/2001Sci...294.1691S The NEA population is more highly inclined than previously estimated, and the total number of kilometer-sized NEAs is estimated at 1227_{-90}^{+170} (1σ).

2001, Nov 8	Apollo NEA 2017 VW13 ($H = 20.6$ mag, $D \approx 270$ m, PHA) passed Earth at a nominal miss distance of 0.37 LD. Minimum miss distance 0.32 LD. [2001-02] See: 2017 VW13 - JPL , 2017 VW13 - SSA
2001, Nov 17	Trans-Carpathians Fireball. The bolide, EN171101, which entered the atmosphere near the village Turýi Remety in the Trans-Carpathians (Ukraine) was photographed by the Czech and Slovakia chambers of the European Bolide Network. The length of the luminous track reached 107 km, starting at an altitude of 81 km. The initial mass was estimated at 4500 kg. Ref: - K.I. Churyumov, R.A. Belevtsev, E.V. Sobotovich, et al., 2010, in: J.A. Fernández, et al. (eds.), <i>Icy Bodies of the Solar System</i>, Proc. IAU Symp. No. 263, Rio de Janeiro (Brazil) 3-7 August 2009 (Cambridge: CUP), p. 244, "Magnetic microspheric particles from bright bolide of EN171101, exploded above the Trans-Carpathians mountains on November 17, 2001." See: http://adsabs.harvard.edu/abs/2010IAUS..263..244C
2001, Nov 18	Fireball, Smoke Trail, Meteor Storm, over Spruce Knob (WV, USA). See: http://apod.nasa.gov/apod/ap011122.html
2001, Nov 18	Leonids Meteor Shower Fireball, over Hawaii (USA). See: http://apod.nasa.gov/apod/ap011119.html
2001, Nov 23	J.S. Stuart, 2001, <i>Science</i>, 294, 1691, "A Near-Earth Asteroid population estimate from the LINEAR survey." See: http://adsabs.harvard.edu/abs/2001Sci...294.1691S See also: http://www.sciencemag.org/content/294/5547/1691.full.pdf http://www.scientificamerican.com/article.cfm?id=new-studies-sharpen-pictu
2001, Nov 23	W.F. Bottke, D. Vokrouhlický, M. Brož, D. Nesvorný, A. Morbidelli, 2001, <i>Science</i>, 294, 1693, "Dynamical spreading of asteroid families by the Yarkovsky Effect." See: http://adsabs.harvard.edu/abs/2001Sci...294.1693B See also: http://www.scientificamerican.com/article.cfm?id=new-studies-sharpen-pictu
2001, Nov 23	P. Michel, W. Benz, P. Tanga, D.C. Richardson, 2001, <i>Science</i>, 294, 1696, "Collisions and gravitational re-accumulation: forming asteroid families and satellites." See: http://adsabs.harvard.edu/abs/2001Sci...294.1696M

	See also: http://www.scientificamerican.com/article.cfm?id=new-studies-sharpen-pictu
2001, Dec 16	Aten NEA 33342 (1998 WT24, $H = 18.3$ mag, $D \approx 415$ m, PHA) passed Earth at a nominal miss distance of 4.86 LD. Minimum miss distance 4.86 LD. See: 1998 WT24 - JPL , 1998 WT24 - SSA See also: http://neo.jpl.nasa.gov/images/1998wt24.html http://science.nasa.gov/science-news/science-at-nasa/2001/ast14dec_1/ http://www.jpl.nasa.gov/news/news.php?feature=4800 https://en.wikipedia.org/wiki/(33342)_1998_WT24 See also: 16 Dec 1908, 16 Dec 1956, 11 Dec 2015, 18 Dec 2099
2002, Jan 1	1683 NEAs known, of which 373 PHAs. See: http://neo.jpl.nasa.gov/stats/
2002	Russian and Ukrainian organizations founded the Planetary Defence Centre (Khimki-2, Moscow, Russian Federation) as a nonprofit-making partnership, with a view to combining the efforts of organizations and experts working in various fields towards the establishment of a planetary defence system. The activities of the Planetary Defence Centre are based on the conceptual design for the 'Citadel Planetary Defence System', which has been approved by the Centre's member organizations. See: http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_863Add1E.pdf http://www.unoosa.org/pdf/pres/stsc2010/tech-43.pdf
2002	W.F. Bottke, A. Cellino, P. Paolicchi & R.P. Binzel (eds.), 2002, <i>Asteroids III</i>, Proceedings International meeting <i>Asteroids 2001: From Piazzzi to the 3rd Millennium</i>, Palermo (Sicily, Italy), 11-16 June 2001 (Tucson: Univ. Arizona Press). See: http://adsabs.harvard.edu/abs/2002aste.conf....B Among the papers: - A. Milani, S.R. Chesley, P.W. Chodas, G.B. Valsecchi, 2002, p. 55, "Asteroid close approaches: analysis and potential impact detection." See: http://adsabs.harvard.edu/abs/2002aste.book...55M https://cneos.jpl.nasa.gov/doc/milani_impact_paper.html - G.H. Stokes, J.B. Evans, S.M. Larson, 2002, p. 45, "Near-Earth Asteroid search programs." See: http://adsabs.harvard.edu/abs/2002aste.conf...45S http://www.lpi.usra.edu/books/AsteroidsIII/pdf/3037.pdf
2002	C. Koeberl, K.G. MacLeod (eds.), 2002, Proceedings International conference on Catastrophic Events & Mass Extinctions: Impacts

	<i>and Beyond</i>, 9-12 Jul 2000, Vienna (Austria), <i>Geological Society of America Special Papers</i>, Vol. 356, "Catastrophic events and mass extinctions: impacts and beyond." See: http://specialpapers.gsapubs.org/content/356 See: http://adsabs.harvard.edu/abs/2002caev.book.....K Among the papers: - U. Köehler, 2002, <i>GSA SP</i>, 356, 1, "Meteors and comets in ancient Mexico." See: http://specialpapers.gsapubs.org/content/356 - C.R. Chapman, 2002 <i>GSA SP</i>, 356, 7, "Impact lethality and risks in today's world: Lessons for interpreting Earth history." See: http://specialpapers.gsapubs.org/content/356/7.abstract - F.T. Kyte, 2002, <i>GSA SP</i>, 356, 21, "Tracers of the extraterrestrial component in sediments and inferences for Earth's accretion history." See: http://specialpapers.gsapubs.org/content/356/21.abstract - J. Morgan, M. Warner, R. Grieve, 2002, <i>GSA SP</i>, 356, 39, "Geophysical constraints on the size and structure of the Chicxulub impact crater." See: http://specialpapers.gsapubs.org/content/356/39.abstract - E. Lounejeva, M. Ostroumov, G. Sánchez-Rubio, 2002, <i>GSA SP</i>, 356, 47, "Micro-Raman and optical identification of coesite in suevite from Chicxulub." See: http://specialpapers.gsapubs.org/content/356/47.abstract - P. Claeys, W. Kiessling, W. Alvarez, 2002, <i>GSA SP</i>, 356, 55, "Distribution of Chicxulub ejecta at the Cretaceous-Tertiary boundary." See: http://specialpapers.gsapubs.org/content/356/55.abstract - T. Matsui, F. Imamura, E. Tajika, et al., 2002, <i>GSA SP</i>, 356, 69, "Generation and propagation of a tsunami from the Cretaceous-Tertiary impact event." See: http://specialpapers.gsapubs.org/content/356/69.abstract - R.D. Norris, J.V. Firth, 2002, <i>GSA SP</i>, 356, 79, "Mass wasting of Atlantic continental margins following the Chicxulub impact event." See: http://specialpapers.gsapubs.org/content/356/79.abstract - F. Martínez-Ruiz, M. Ortega-Huertas, I. Palomo, J. Smit, 2002, <i>GSA SP</i>, 356, 189, "Cretaceous-Tertiary boundary at Blake Nose (Ocean Drilling Program Leg 171B): A record of the Chicxulub impact ejecta." See: http://specialpapers.gsapubs.org/content/356/189.abstract - E. Díaz-Martínez, E. Sanz-Rubio, J. Martínez-Frías, 2002, <i>GSA SP</i>, 356, 551, "Sedimentary record of impact events in Spain." See: http://specialpapers.gsapubs.org/content/356/551.abstract - A. Raukas, 2002, <i>GSA SP</i>, 356, 563, "Postglacial impact events in Estonia and their influence on people and the environment." See: http://specialpapers.gsapubs.org/content/356/563.abstract - P.S. DeCarli, E. Bowden, A.P. Jones, G.D. Price, 2002, <i>GSA SP</i>, 356, 595, "Laboratory impact experiments versus natural impact events." See: http://specialpapers.gsapubs.org/content/356/595.abstract - B.A. Ivanov, N.A. Artemieva, 2002, <i>GSA SP</i>, 356, 619, "Numerical

	modeling of the formation of large impact craters." See: http://specialpapers.gsapubs.org/content/356/619.abstract - E.W. Elst, 2002, <i>GSA SP</i>, 356, 645, "On the completeness of the discovery rate of the potentially hazardous asteroids." See: http://specialpapers.gsapubs.org/content/356/645.abstract - N.A. Solovaya, E.M. Pittich, 2002, <i>GSA SP</i>, 356, 651, "Possible sources of Earth crossers." See: http://specialpapers.gsapubs.org/content/356/651.abstract - R.A. Muller, 2002, <i>GSA SP</i>, 356, 659, "Measurement of the lunar impact record for the past 3.5 b.y. and implications for the Nemesis theory." See: http://specialpapers.gsapubs.org/content/356/659.abstract - M.R. Rampino, 2002, <i>GSA SP</i>, 356, 667, "Role of the galaxy in periodic impacts and mass extinctions on the Earth." See: http://specialpapers.gsapubs.org/content/356/667.abstract - C.A. Olano, 2002, <i>GSA SP</i>, 356, 679, "Solar system linked to a gigantic interstellar cloud during the past 500 m.y.: Implications for a galactic theory of terrestrial catastrophism." See: http://specialpapers.gsapubs.org/content/356/679.abstract - V.V. Svetsov, 2002, <i>GSA SP</i>, 356, 685, "Grazing meteoroids could ignite continental-scale fires." See: http://specialpapers.gsapubs.org/content/356/685.abstract - V.V. Shuvalov, N.A. Artemieva, 2002, <i>GSA SP</i>, 356, 695, "Atmospheric erosion and radiation impulse induced by impacts." See: http://specialpapers.gsapubs.org/content/356/695.abstract - M.V. Gerasimov, 2002, <i>GSA SP</i>, 356, 705, "Toxins produced by meteorite impacts and their possible role in a biotic mass extinction." See: http://specialpapers.gsapubs.org/content/356/705.abstract - T. Luder, W. Benz, T.F. Stocker, 2002, <i>GSA SP</i>, 356, 717, "Modeling long-term climatic effects of impacts: First results." See: http://specialpapers.gsapubs.org/content/356/717.abstract - J.T. Wasson, M.B.E. Boslough, 2002, "Large Aerial Bursts; an important class of terrestrial accretionary events." See: http://adsabs.harvard.edu/abs/2001caev.conf.3152W
2002	S.N. Ward, E. Asphaug, 2002, <i>Deep-Sea Research</i>, Part II, 49, 1073, "Impact tsunami - Eltanin." See: http://www.es.ucsc.edu/~ward/papers/final_eltanin.pdf
2002, Jan	J. Spitale, R. Greenberg, 2002, <i>Icarus</i>, 149, 222, "Numerical evaluation of the general Yarkovsky effect: effects on semi-major axis." See: http://adsabs.harvard.edu/abs/2002Icar..156..211S
2002, Jan 7	Apollo NEA 2001 YB5 ($H = 20.4$ mag, $D \approx 290$ m, PHA) passed Earth at a nominal miss distance of 2.16 LD. Minimum miss distance 2.16 LD.

	See: 2001 YB5 - JPL , 2001 YB5 - SSA See also: http://www.planetary.org/news/2002/0109_Asteroid_Gives_Earth_a_Close_Flyby.html http://en.wikipedia.org/wiki/Delta_Cancrids http://en.wikipedia.org/wiki/2001_YB5
2002, Jan 22	Apollo NEA 4660 Nereus (1982 DB, $H = 18.5$ mag, $D = 510 \times 330 \times 240$ m, PHA) passed Earth at 11.30 LD. Minimum miss distance 11.30 LD. See: 1982 DB - JPL , 4660 Nereus - SSA Ref: - M. Brozovic, S.J. Ostro, L.A.M. Benner, et al., 2009, <i>Icarus</i>, 201, 153, "Radar observations and a physical model of asteroid 4660 Nereus, a prime space mission target." See: http://adsabs.harvard.edu/abs/2009Icar..201..153B - K. Kitazato, S. Abe, M. Ishiguro, et al., October 2012, American Astronomical Society, DPS meeting #44, #210.20, "Measuring the YORP effect of asteroid 4660 Nereus." See: http://adsabs.harvard.edu/abs/2012DPS....4421020K See also: http://en.wikipedia.org/wiki/4660_Nereus See also: 29 Jan 1900, 11 Dec 2021, 14 Feb 2060, 4 Feb 2071, 23 Dec 2112, 4 Feb 2166.
2002, Feb	Spaceguard Survey update: 587 of the larger ($D > 1$ km) NEAs found. The present number of NEAs of all sizes is 1743. See:
2002, Feb	D. Morrison, 2002, <i>Astronomy</i>, 30, No. 2, p. 46, "Target Earth." See: http://adsabs.harvard.edu/abs/2002Ast....30b..46M
2002, Feb	E.F. Tedesco, P.V. Noah, M. Noah, S.D. Price, 2002, <i>Astronomical Journal</i>, 123, 1056, "The Supplemental IRAS minor planet survey." See: http://adsabs.harvard.edu/abs/2002AJ....123.1056T
2002, Feb 1	World's asteroid hunters make political plea to save earth. An international group of astronomers appeal to the Australian government for an Australian Spaceguard Program.
2002, Feb 18	Start of project KLENOT, the Klet' Observatory Near Earth and other Unusual Objects Observation Team and Telescope (České Budějovice, Czech Republic), dedicated to confirmation, follow-up astrometry, and recovery of NEOs. 1.06-m telescope, $33' \times 33'$ FoV, limiting magnitude $v = 22.0$ mag. Ref: - J. Tichá, M. Tichý, Z. Moravec, 2000, <i>Planetary and Space</i>

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2002, Mar	S.C. Werner, A.W. Harris, G. Neukum, B.A. Ivanov, 2002, <i>Icarus</i>, 156, 287, "The Near-Earth Asteroid size-frequency distribution: a snapshot of the Lunar impactor size-frequency distribution." See: http://adsabs.harvard.edu/abs/2002Icar..156..287W
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2002, Mar 8	Aten NEA 2002 EM7 ($H = 25.0$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 1.21 LD (and the Moon at 0.4 LD). Minimum miss distance 1.21 LD. See: 2002 EM7 - JPL , 2002 EM7 - SSA
2002, Mar 12	NASA's Near-Earth Object Program Office at JPL puts its SENTRY automatic approach monitoring system on-line, complementary to the NEODyS CLOMON2 (Pisa, Italy) close approach monitoring system. Ref: - A.B. Chamberlin, S.R. Chesley, P.W. Chodas, J.D. Giorgini, M.S. Keesey, R.N. Wimberly, D.K. Yeomans, 2001, <i>Bull. Am. Astron. Soc.</i>, "SENTRY: an automated close approach monitoring system for Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2001DPS....33.4108C See also: http://neo.jpl.nasa.gov/news/news126.html
2002, Mar 24	Apollo NEA 2021 FP2 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a

	nominal miss distance of 1.62 LD. Minimum miss distance 0.32 LD. See: 2021 FP2 – S2P , 2021 FP2 – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 2021 Mar 23 .
2002, Apr	W.F. Bottke, A. Morbidelli, R. Jedicke, et al., 2002, <i>Icarus</i> , 156, 399, "Debiased orbital and absolute magnitude distribution of the Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2002Icar..156..399B
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2002, Apr	S.N. Ward, 2002, <i>Journal of Geophysical Research (Planets)</i> , 107, Issue E4, pp. 7, "Planetary cratering: a probabilistic approach." See: http://adsabs.harvard.edu/abs/2002JGRE..107.5023W
2002, Apr	UK Near Earth Object Information Centre (NEOIC) operational, based at the British National Space Center in Leicester (UK). See: http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_863Add1E.pdf
2002, Apr 5	J.N. Spitale, 2002, <i>Science</i> , 296, 77, "Asteroid hazard mitigation using the Yarkovsky effect." See: http://www.sciencemag.org/content/296/5565/77.full?sid=e6448a4d-56dc-4871-9350-473e46679372
2002, Apr 6	Neuschwanstein meteorite detected by the European Fireball Network . Fell to Earth near Neuschwanstein Castle, Bavaria, at the Germany-Austria border. The original meteorite burst into several fragments at a height of about 22 kilometers above the ground. The fragments descended on an area of several square kilometers. Three fragments were recovered with a total mass of about six kilograms. Ref: - P. Spurný, J. Oberst, D. Heinlein, 2003, <i>Nature</i> , 423, 151, "Photographic observations of Neuschwanstein , a second meteorite from the orbit of the Příbram chondrite." See: http://adsabs.harvard.edu/abs/2003Natur.423..151S - J. Oberst, D. Heinlein, U. Köhler, P. Spurný, 2004, <i>Meteoritics & Planetary Science</i> , 39, 1627, "The multiple meteorite fall of Neuschwanstein : Circumstances of the event and meteorite search campaigns". See: http://adsabs.harvard.edu/abs/2004M%26PS...39.1627O See also: http://en.wikipedia.org/wiki/Neuschwanstein_(meteorite)

2002, Apr 24	Atira NEA 434326 (2004 JG6), $H = 18.7$ mag, $D \approx 700$ m, PHA) passed Earth at 16.79 LD. Minimum miss distance 16.79 LD. See: 2004 JG6 - JPL , 2004 JG6 - SSA , This NEA has the smallest orbit known around the Sun ($P = 184.9$ days). See also: http://www.spacedaily.com/news/asteroid-04g.html http://adsabs.harvard.edu/abs/2004S%26T...108c..18M http://en.wikipedia.org/wiki/2004_JG6
2002, May 4-11	European Science Foundation Research Networking Programme Response of the Earth System to Impact Processes (IMPACT), Short Course on <i>Impact Stratigraphy</i>, Osservatorio Geologico do Coldigioco (Italy). See: http://www.esf.org/activities/research-networking-programmes/life-earth-and-environmental-sciences-lesc/completed-esf-research-networking-programmes-in-life-earth-and-environmental-sciences/response-of-the-earth-system-to-impact-processes-impact/science-meetings.html
2002, May 10	H.J. Melosh, 2002, <i>Science</i>, 296, 1037, "Traces of an unusual impact." See: http://www.sciencemag.org/content/296/5570/1037.summary?sid=b5c3152b-80ef-4804-9780-89f7132af4b8 See also: http://www.skyandtelescope.com/news/3306051.html http://en.wikipedia.org/wiki/Rio_Cuarto_craters
2002, May 10	P.A. Bland, C.R. de Souza Filho, A.J.T. Jull, 2002, et al., <i>Science</i>, 296, 1109, "A possible tektite strewn field in the Argentinian pampa." See: http://www.sciencemag.org/content/296/5570/1109.abstract See also: http://www.skyandtelescope.com/news/3306051.html http://en.wikipedia.org/wiki/Rio_Cuarto_craters
2002, May 17-19	Meeting on Asteroids and Comets in Europe, Visnjan (Croatia). See: http://www.astro.hr/mace2002/
2002, May 24	J.-L. Margot, M.C. Nolan, L.A.M. Benner, et al., 2002, <i>Science</i>, 296, 1445, "Binary asteroids in the Near-Earth Object population." See: http://adsabs.harvard.edu/abs/2002Sci...296.1445M
2002, May 31-Jun 3	European Science Foundation Research Networking Programme Response of the Earth System to Impact Processes (IMPACT), Workshop on <i>Impact Tectonism</i>, Mora (Sweden). See: http://www.esf.org/activities/research-networking-programmes/life-

	earth-and-environmental-sciences-lesc/completed-esf-research-networking-programmes-in-life-earth-and-environmental-sciences/response-of-the-earth-system-to-impact-processes-impact/science-meetings.html
2002, Jun	J.L. Remo, 2002, <i>Acta Astronautica</i> , 50, 737, "Characterizing the Near-Earth Object hazard and its mitigation." See: http://adsabs.harvard.edu/abs/2002AcAau..50..737R
2002, Jun	V. Zappalà, A. Cellino, A., Dell'Oro, 2002, <i>Icarus</i> , 157, 280, "A search for the collisional parent bodies of large NEAs." See: http://adsabs.harvard.edu/abs/2002Icar..157..280Z
2002, Jun 6	Eastern Mediterranean Fireball and Airburst. Estimated ~ 10 m object exploded in mid-air between Libya and Crete. See: http://abob.libs.uga.edu/bobk/cc/cc071502.html http://www.spaceref.com/news/viewpr.html?pid=8834 http://en.wikipedia.org/wiki/Eastern_Mediterranean_event http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
2002, Jun 14	Apollo NEA 2002 MN ($H = 23.9$ mag, $D \approx 60$ m) passed Earth at a nominal miss distance of 0.31 LD. Minimum miss distance 0.31 LD. [2002-01] See: 2002 MN - JPL , 2002 MN - SSA Ref: - D. Morrison, C.R. Chapman, D. Steel, R.P. Binzel, 2004, in: M.J.S. Belton, et al. (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 353, "Impacts and the public: communicating the nature of impact hazard." See: http://adsabs.harvard.edu/abs/2004mhca.conf..353M - B.G. Marsden, 2007, in: P. Bobrowsky & H. Rickman (eds.), 2007, <i>Comet/Asteroid Impacts and Human Society</i> (Berlin: Springer), p. 505, "Impact risk communication management (1998 – 2004): Has it improved?" See: http://adsabs.harvard.edu/abs/2007caih.book.....B See also: http://www.planetary.org/news/2002/0624_The_Close_Call_that_was_Asteroid_2002.html http://antwrp.gsfc.nasa.gov/apod/ap050417.html http://www.scientificamerican.com/article.cfm?id=avoiding-the-impact http://en.wikipedia.org/wiki/2002_MN
2002, Jul	E.F. Tedesco, M.P. Egan, S.D. Price, 2002, <i>Astronomical Journal</i> , 124, 583, "The Midcourse Space Experiment infrared minor planet survey." See: http://adsabs.harvard.edu/abs/2002AJ....124..583T

2002, Jul 15	USAF General Simon P. Worden, 10 July 2002, speech: "Military perspectives on the Near-Earth Object (NEO) threat." " Introduction: A few weeks ago the world almost saw a nuclear war. Pakistan and India were at full alert and poised for a large-scale war - which both sides appeared ready to escalate into nuclear war. The situation was defused - for now! Most of the world knew about this situation and watched and worried. But few know of an event over the Mediterranean in early June of this year that could have had a serious bearing on that outcome. U.S. early warning satellites detected a flash that indicated an energy release comparable to the Hiroshima burst. We see about 30 such bursts per year, but this one was one of the largest we've ever seen. The event was caused by the impact of a small asteroid - probably about 5-10 meters in diameter on the earth's atmosphere. Had you been situated on a vessel directly underneath the intensely bright flash would have been followed by a shock wave that would have rattled the entire ship and possibly caused minor damage. The event of this June caused little or no notice as far as we can tell. But had it occurred at the same latitude, but a few hours earlier, the result on human affairs might have been much worse. Imagine that the bright flash accompanied by a damaging shock wave had occurred over Delhi, India or Islamabad, Pakistan? Neither of those nations have the sophisticated sensors we do that can determine the difference between a natural NEO impact and a nuclear detonation. The resulting panic in the nuclear-armed and hair-trigger militaries there could have been the spark that would have ignited the nuclear horror we'd avoided for over a half-century. This situation alone should be sufficient to get the world to take notice of the threat of asteroid impact." . . . See: http://www.spaceref.com/news/viewpr.html?pid=8834 Comment: D. Morrison, 15 July 2002, "On impact frequency and need for a warning center." See: http://abob.libs.uga.edu/bobk/cc/cc071702.html
2002, Jul 25	R. Schoenberg, B.S. Kamber, K.D. Collerson, S. Moorbath, 2002, <i>Nature</i>, 418, 403, "Tungsten isotope evidence from 3.8 Gyr metamorphosed sediments for early meteorite bombardment of the Earth". See: http://adsabs.harvard.edu/abs/2002Natur.418..403S
2002, Jul 29 – Aug	<i>International conference on Asteroids, Comets, Meteors, VIII</i>, 29 July - 2 August 2002, Berlin (Germany). Proceedings: B. Warmbein (ed.), 2002, <i>Asteroids, Comets, Meteors 2002</i>, ESA-SP 500 (Noordwijk: ESA). See: http://adsabs.harvard.edu/abs/2002ESASP.500.....W

	See also: Among the papers: - F. Bernardi, A. Boattini, G. D'Abramo, 2002, ESA SP-500, p. 801, "The Campo Imperatore Near Earth Objects Survey (CINEOS)." See: http://adsabs.harvard.edu/abs/2002ESASP.500..801B - R.P. Binzel, 2002, ESA SP-500 (Noordwijk: ESA), p. 5, "Asteroids, comets, Kuiper Belt objects, meteors: the ACM (AKM) 2002 perspective." See: http://adsabs.harvard.edu/abs/2002ESASP.500....5B - M. Delbò, A.W. Harris, R. Binzel, et al., 2002, ESA SP-500 (Noordwijk: ESA), p. 891, "Surveying near-Earth asteroids in the thermal infrared." See: http://adsabs.harvard.edu/abs/2002ESASP.500..891D - M. Leipold, A. von Richter, G. Hahn, et al., 2002, ESA SP-500 (Noordwijk: ESA), p. 107, "Earthguard-I: a NEO detection space mission." See: http://adsabs.harvard.edu/abs/2002ESASP.500..107L - J. de León, M. Serra-Ricart, J. Licandro, L., Dominigüez, 2002, ESA SP-500 (Noordwijk: ESA), p. 911, "Monitoring and physical characterization of Near Earth Objects." See: http://adsabs.harvard.edu/abs/2002ESASP.500..911D
2002, Aug	C.A. Angeli, D. Lazzaro, 2002, <i>Astronomy & Astrophysics</i>, 391, 757, "Spectral properties of Mars-crossers and near-Earth objects. Results of the S³OS² survey." See: http://adsabs.harvard.edu/abs/2002A%26A...391..757A S³OS²: Small Solar System Objects Spectroscopic Survey – carried out at the ESO (La Silla, Chile). See also: http://sbn.psi.edu/pds/resource/s3os2.html
2002, Aug	S.P. Kelley, E. Gurov, 2002, <i>Meteoritics & Planetary Science</i>, 37, 1031, "The Boltys, another end-Cretaceous impact." See: http://adsabs.harvard.edu/abs/2002M%26PS...37.1031K http://www.skyandtelescope.com/news/3306656.html?page=1&c=y
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2002, Aug 3	Apollo NEA 2013 YP139 ($H = 21.2$ mag, $D \approx 968$ m, PHA) passed Earth at a nominal miss distance of 4.12 LD. Minimum miss distance 4.12 LD. See: 2013 YP139 - JPL , 2013 YP139 - SSA See also: 12 Dec 2069 .
2002, Aug 18	Apollo NEA 2002 NY40 ($H = 19.3$ mag, $D \approx 280$ m, PHA) passed Earth at 1.37 LD. Minimum miss distance 1.37 LD. See: 2002 NY40 - JPL , 2002 NY40 - SSA Ref: - R.W. Sinnott, 23 July 2003, <i>Sky & Telescope</i> , "Hefty asteroid to sweep near Earth." See: http://www.skyandtelescope.com/news/3306351.html - L.C. Roberts, D.T. Hall, J.V. Lambert, et al., 2007, <i>Icarus</i> , 192, 469, "Characterization of the near-Earth asteroid 2002 NY40 ." See: http://adsabs.harvard.edu/abs/2007Icar..192..469R - J.M. Trigo-Rodríguez, E. Lyytinen, D.C. Jones, et al., 2007, <i>Monthly Notices of the Royal Astronomical Society</i> , 382, 1933, "Asteroid 2002 NY40 as a source of meteorite-dropping bolides." See: http://adsabs.harvard.edu/abs/2007MNRAS.382.1933T See also: http://antwrp.gsfc.nasa.gov/apod/ap020817.html http://www.planetary.org/news/2002/0802_Your_Chance_to_See_a_NEO.html See also: 11 Feb 2038 .
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2002, Sep 15	Aten NEA 2020 RD4 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 7.06 LD. Minimum miss distance 0.03 LD. See: 2020 RD4 – S2P , 2020 RD4 - JPL See also: 14 Sep 2020, 15 Sep 2079.
2002, Sep 25	Vitim Fireball and Airburst event. Believed to be an impact by a bolide or comet nucleus in the Vitim River basin, near Bodaybo (Mamsko-chuisky district, Irkutsk Oblast, Siberia, Russia). Explosion energy estimates range from 0.2 to 5 kT. See: http://www.absoluteastronomy.com/topics/Meteorite http://en.wikipedia.org/wiki/Vitim_event http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
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2002, Oct	S.R. Chesley, P.W. Chodas, A. Milani, G.B. Valsecchi, D.K. Yeomans, D.K., 2002, <i>Icarus</i>, 159, 423, "Quantifying the risk posed by potential Earth impacts." Defining the Palermo Technical Impact Hazard Scale. See: http://adsabs.harvard.edu/abs/2002Icar..159..423C https://cneos.jpl.nasa.gov/doc/chesley_impact_paper.html See also: http://neo.jpl.nasa.gov/risk/doc/palermo.html
2002, Oct 3	Brig. Gen. Simon P. Worden, United States Strategic Command, U.S. Congressional Hearing Statement, before the House Science Committee, Space and Aeronautics Subcommittee, on Near-Earth Object Threat: "The Threat of Near-Earth Asteroids." See: http://www.spaceref.com/news/viewsr.html?pid=6723 See also: 15 Jul 2002.
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	Hut, Ed T. Lu, and Russell L. Schweickart. Goal: to significantly alter the orbit of an asteroid, in a controlled manner, by 2015. A private California non-profit foundation. See: http://www.b612foundation.org/
2002, Oct 12-16	European Science Foundation Research Networking Programme <i>Response of the Earth System to Impact Processes (IMPACT)</i>, Workshop on Impacts: a Geological and Astronomical Perspective, Prague (Czech Republic). See: http://www.esf.org/activities/research-networking-programmes/life-earth-and-environmental-sciences-lesc/completed-esf-research-networking-programmes-in-life-earth-and-environmental-sciences/response-of-the-earth-system-to-impact-processes-impact/science-meetings.html
2002, Oct 29	C.A. Glatz, D.H. Abbott, A.A. Nunes, 2002, in: <i>2002 Denver Annual Meeting</i> of the Geological Society of America, Denver, (CO, USA), 27-30 October 2002, paper no. 178-7, "A possible source crater for the Eltanin impact layer." See: http://gsa.confex.com/gsa/2002AM/finalprogram/abstract_45134.htm
2002, Nov	M.H.M. Morais, A. Morbidelli, 2002, <i>Icarus</i>, 160, 1, "The population of Near-Earth Asteroids in coorbital motion with the Earth." See: http://adsabs.harvard.edu/abs/2002Icar..160....1M
2002, Nov 2	NASA spacecraft Stardust flew within 3300 km of inner Main-belt asteroid 5535 Annefrank (1942 EM, $H = 13.7$ mag, $D = 6.6 \times 5.0 \times 3.4$ km). See: 1942 EM - JPL , 5535 Annefrank - SSA , Ref: - J.K. Hillier, J.M. Bauer, B.J. Buratti, 2011, <i>Icarus</i>, 211, 546, "Photometric modelling of asteroid 5535 Annefrank from Stardust." See: http://adsabs.harvard.edu/abs/2011Icar..211..546H See also: http://en.wikipedia.org/wiki/5535_Annefrank
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2003	T. Palmer, 2003, <i>Perilous planet Earth: catastrophes and catastrophism through the ages</i> (Cambridge: CUP). See: http://adsabs.harvard.edu/abs/2003ppe..book....P
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	<i>Future In This Century – On Earth and Beyond</i> (New York: Basic Books), p. 89, "Chapter 7. Baseline natural hazards. Asteroid impacts." See: http://adsabs.harvard.edu/abs/2003ofhs.book.....R
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2003, Jan 4	A.P.J. Abdul Kalam, President of India, 4 January 2003, Space Summit Address to the 90th Indian Science Congress, "Vision for the global space community: prosperous, happy and secure planet earth." See: http://neo.jpl.nasa.gov/1950da/1950DA_Kalam_90th_Indian_Congress.pdf
2003, Jan 8	Aten NEA 2002 AA29 ($H = 24.5$ mag, $D \approx 25$ m) passed Earth at 15.22 LD. Minimum miss distance 15.22 LD. See: 2002 AA29 - JPL , 2002 AA29 - SSA See also: http://neo.jpl.nasa.gov/news/news137.html http://www.spaceref.com/news/viewpr.html?pid=8834 https://cneos.jpl.nasa.gov/doc/2002aa29/ http://en.wikipedia.org/wiki/2002_AA29
2003, Jan 8	R.L. Schweickart, 2003, "The need for a United Nations asteroid deflection treaty to establish a system for trustworthy mission design and execution." See: http://www.b612foundation.org/papers/OECD_trustworthy.pdf
2003, Jan 9	C.R. Chapman, 2003, in: OECD Global Science Forum Workshop <i>Near Earth Objects: Risk, Policies and Actions</i>, Frascati (Italy) 20-22 January 2003, "How a Near-Earth Object impact might affect society." See: http://www.oecd.org/dataoecd/18/40/2493218.pdf

2003, Jan 20-22	Organization for Economic Cooperation and Development (OECD, Paris, France) Global Science Forum Workshop on Near Earth Objects: Risk, Policies and Actions, hosted by ESRIN, Frascati (Italy). Final report of 11 August 2004. See: http://www.iau.org/static/publications/IB93.pdf , p. 13, "NEO-related activities". The Workshop stated: • “.. assess the NEO hazard as it relates to public safety, determine the commensurate level of response, and undertake appropriate actions at national and international levels.” • “.. each government that has not already done so consider designating a responsible official (office, administration, etc.) within the government, tasked with following the ever-growing body of knowledge about NEO impacts, and, where appropriate, advising the government regarding the implications for public safety of the NEO risk. • “explore strategies for mitigating the impact of a range of characteristic NEOs, identifying the scientific, technical, legal and policy implications of mounting a NEO negation mission..” Ref: - D. Morrison, C.R. Chapman, D. Steel, R.P. Binzel, 2004, in: M.J.S. Belton, et al. (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 353, "Impacts and the public: communicating the nature of impact hazard." See: http://adsabs.harvard.edu/abs/2004mhca.conf..353M See also: http://www.oecd.org/document/17/0,3343,en_2649_34319_2767633_1_1_1_1,00.html http://www.oecd.org/dataoecd/39/40/2503992.pdf
2003, Feb	Lowell Observatory (Flagstaff, AZ, USA) and Discovery Communications formed a partnership to build the 4.2m Discovery Channel Telescope. First light expected by the end of 2010. Ref: - E. Bowell, R.L. Millis, E.W. Dunham, et al., 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symposium No. 236 on <i>Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i>, Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 363, "Searching for NEOs using the Lowell Observatory's Discovery Channel Telescope (DCT)." See: http://adsabs.harvard.edu/abs/2007IAUS..236..363B
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2003, Feb 10	Great Impact Debates, <i>Astrobiology Magazine</i> , 10 February 2003, "The benefits of hard bodies." See: http://www.astrobio.net/debate/373/the-benefits-of-hard-bodies
2003, Feb 11	First discovery of an IEO asteroid: 163693 Atira (2003 CP20 , $H = 16.5$, $D \approx 1800$ m), by the LINEAR team of the Lincoln Near-Earth Asteroid Research at Lincoln Laboratory's Experimental Test Site near Socorro (NM, New Mexico, USA). Atira is the Pawnee goddess of Earth and the evening star. This is the first numbered minor planet to have an orbit completely interior to that of the Earth. See: 2003 CP20 - JPL , 163693 Atira - SSA See also: http://en.wikipedia.org/wiki/163693_Atira
2003, Feb 14	Symposium on The Asteroid/Comet Impact Hazard: A Decade of Growing Awareness , American Association for the Advancement of Science (AAAS), Denver (CO, USA), marking the 10 th anniversary of the Spaceguard Report . See: http://www.aaas.org/news/releases/2003/0122am.shtml
2003, Feb 17	Great Impact Debates, <i>Astrobiology Magazine</i> , 17 February 2003, "Much ado about nothing?" See: http://www.astrobio.net/debate/378/much-ado-about-nothing
2003, Feb 24	Great Impact Debates, <i>Astrobiology Magazine</i> , 24 February 2003, "The large and the small." See: http://www.astrobio.net/debate/382/the-large-and-the-small
2003, Mar 3	Great Impact Debates, <i>Astrobiology Magazine</i> , 3 March 2003, "Collision course for Earth." See: http://www.astrobio.net/debate/389/collision-course-for-earth
2003, Mar 14	M. Belló, J.A. González, A. Milani, G. Valsecchi, P. Paolicchi, et al., 2003, <i>NEO-DMS-EXS</i> , "Near Earth Objects space mission preparation: Don Quijote mission executive summary." ESA study contract. See: http://www.esa.int/gsp/completed/neo/donquijote_execsum.pdf See also: http://www.space.com/12781-space-missions-deflect-dangerous-asteroids-apophis.html

2003, Mar 16	Technical workshop <i>Tsunami Hazard Workshop</i> , Houston (TX, USA).
2003, Mar 27	Park Forest Fireball and Meteorite . Bolide entering the Earth atmosphere over Park Forest (IL, USA) south of Chicago, detected by U.S. Department of Energy and Department of Defense satellites. Estimated initial NEA diameter $D \approx 1.8$ m, estimated initial mass $M \approx 11,000$ kg. Ref: - P. Brown, D. Pack, W.N. Edwards, et al., 2004, <i>Meteoritics & Planetary Science</i> , 39, 1781, "The orbit, atmospheric dynamics, and initial mass of the Park Forest Meteorite ." See: http://adsabs.harvard.edu/abs/2004M%26PS...39.1781B See also: http://apod.nasa.gov/apod/ap030506.html http://apod.nasa.gov/apod/ap050724.html
2003, Apr 3	Apollo NEA 2003 GG21 ($H = 22.1$ mag, $D \approx 140$ m, PHA) passed Earth at a nominal miss distance of 3.39 LD. Minimum miss distance 3.39 LD. See: 2003 GG21 - JPL , 2003 GG21 - SSA
2003, Apr 13-16	European Science Foundation Research Networking Programme <i>Response of the Earth System to Impact Processes (IMPACT)</i>, Workshop on Biological Processes in Impact Craters , Cambridge (UK). See: http://www.esf.org/activities/research-networking-programmes/life-earth-and-environmental-sciences-lesc/completed-esf-research-networking-programmes-in-life-earth-and-environmental-sciences/response-of-the-earth-system-to-impact-processes-impact/science-meetings.html
2003, Apr 19	E. Asphaug, 2003, <i>New Scientist</i> , "Taming the heavens." See: http://www.newscientist.com/article/mg17823914.400-taming-the-heavens.html
2003, Apr 22-23	ICSU workshop on NEOs , Paris (France), with IAU, IUGG, IUGS, COSPAR, SCOR, SCOPE, and the USA, as well as the OECD GSF. See: http://www.iau.org/static/publications/IB93.pdf , p. 13, "NEO-related activities."
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2003, May	A. Morbidelli, D. Vokrouhlický, 2003, <i>Icarus</i> , 163, 120, "The Yarkovsky-driven origin of near-Earth asteroids."

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2003, May 1-4	Meeting on Asteroids and Comets in Europe , Costitx (Mallorca, Spain). See: http://www.minorplanets.org/MACE2003/
2003, Jun	G. Masi, 2003, <i>Icarus</i> , 163, 389, "Searching for inner-Earth objects: a possible ground-based approach." See: http://adsabs.harvard.edu/abs/2003Icar..163..389M
2003, Jun 20	A. Milani, 2003, <i>Science</i> , 300, 1882, "Extraterrestrial material – virtual or real hazards?" See: http://www.sciencemag.org/content/300/5627/1882.summary?sid=e377c0b3-994a-4614-bc70-5ee36edb563c
2003, Jul 14	In a letter to Congress, a group of space-savvy Americans urged the U.S. government to begin immediate preparations to deal with the threat of NEOs. See: http://usgovinfo.about.com/cs/technology/a/aaneoletter.htm
2003, Jul 14	S. Nadis, 2003, <i>Scientific American</i> , 14 July 2003, "Keeper of the objects." ... With a shoestring budget, asteroid and comet watcher Brian Marsden looks out for Armageddon from the skies – and not without controversy ... See: http://www.scientificamerican.com/article.cfm?id=keeper-of-the-objects
2003, Jul 22	IAU XXV General Assembly , Sydney (Australia). Division III Working Group on Near-Earth Objects (WG-NEO) meeting . Report by David Morrison, chair WG-NEO. Ref: - D. Morrison, 2007, in: O. Engvold (ed.), 2007, <i>Transactions IAU XXVB</i> (San Francisco: ASP), p. 131, "Working Group on Near-Earth Objects." See: http://www.astrosociety.org/astroshop/index.php?p=product&id=119&parent=8
2003, Jul 23	IAU XXV General Assembly , Sydney (Australia). Joint Discussion 10 on Physical Properties and Morphology of Small Solar System Bodies . In: O. Engvold (ed.), 2005, <i>Highlights of Astronomy</i> , Vol. 13 (San Francisco: ASP), p. 721. See: http://adsabs.harvard.edu/abs/2005HiA....13....E http://www.iau.org/science/publications/iau/highlights/

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2003, Aug 22	G.H. Stokes, D.K. Yeomans, W.F. Bottke, et al. (eds.), 2003, NASA NEO Science Definition Team (SDT) report <i>Study to Determine the Feasibility of Extending the Search for Near-Earth Objects to Smaller Limiting Diameters</i> , NASA Office of Space Science, Solar System Exploration Division, Washington DC, USA (2003). See: http://neo.jpl.nasa.gov/neo/report.html http://neo.jpl.nasa.gov/neo/neoreport030825.pdf https://cneos.jpl.nasa.gov/doc/neoreport030825.pdf
2003, Aug 25	F.A. Macdonald, J.A. Bunting, S.E. Cina, 2003, <i>Earth and Planetary Science Letters</i> , 213, 235, " Yarrabubba - a large, deeply eroded impact structure in the Yilgarn Craton, Western Australia." See: https://ui.adsabs.harvard.edu/abs/2003E%26PSL.213..235M/abstract
2003, Sep	E. Asphaug, 2003, <i>Scientific American</i> , 13, 44, "The small planets." See: http://81.70.242.211/.../Scientific%20American/.../...
2003, Sep 19	Aten NEA 2003 SW130 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2003-02] See: 2003 SW130 - JPL , 2003 SW130 - SSA See also: 19 Sep 1990 .
2003, Sep 27	Apollo NEA 2003 SQ222 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.22 LD. Minimum miss distance 0.22 LD. [2003-03] See: 2003 SQ222 - JPL , 2003 SQ222 - SSA See also: http://antwarp.gsfc.nasa.gov/apod/ap031015.html http://www.newscientist.com/article/dn4228-closest-asteroid-yet-flies-past-earth.html http://www.skyandtelescope.com/news/3308176.html
2003, Sep late	Fireball over South Wales (UK). See: http://apod.nasa.gov/apod/ap031001.html
2003, Oct 12	Apollo NEA 2003 UM3 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.59 LD. [2003-04] See: 2003 UM3 - JPL , 2003 UM3 - SSA

2003, Oct 15	Apollo NEA 69230 Hermes (1937 UB, $H = 17.5$ mag, $D \approx 1100$, PHA) re-discovered. Binary asteroid, each $D \approx 300$ m, <i>separation</i> ≈ 1200 m, $P = 778$ d. See: 1937 UB - JPL , 69230 Hermes - SSA See also: http://www.news.cornell.edu/releases/Oct03/Arecibo.asteroid.deb.html http://science.nasa.gov/headlines/y2003/31oct_hermes.htm http://en.wikipedia.org/wiki/69230_Hermes See also: 29 Oct 1914, 30 Oct 1937, 26 Apr 1942, 1 Nov 1954, 31 Oct 2086, 30 Apr 2123.
2003, Oct 16	W.T. Huntress, 2003, statement before the Committee on Science, U.S. House of Representatives, "The future of human space flight". Advocating <i>inter alia</i> a one-year human mission to a Near Earth Object. See: http://www.access.gpo.gov/congress/house/pdf/108hrg/89892.pdf http://www.planetary.org/programs/projects/aim_for_mars/testimony_huntress_2003.html
2003, Nov	D. Morrison, 2003, <i>Mercury</i>, 32, no. 6, p. 15, "Commentary: are astronomers crying wolf?" See: http://adsabs.harvard.edu/abs/2003Mercur..32f..15M
2003, Nov	R.L. Schweickart, E.T. Lu, P. Hut, C.R. Chapman, 2003, <i>Scientific American</i>, 13 October 2003, "The Asteroid Tugboat." See: http://scientificamerican.com/article.cfm?id=the-asteroid-tugboat See also: http://www.b612foundation.org/press/press.html #3 http://www.b612foundation.org/papers/AT-GT.pdf http://www.nature.com/scientificamerican/journal/v305/n6/full/scientificamerican1211-16.html
2003, Nov	M. Delbò, A.W. Harris, R.P. Binzel, et al., 2003, <i>Icarus</i>, 166, 166, "Keck observations of near-Earth asteroids in the thermal infrared." See: http://adsabs.harvard.edu/abs/2003Icar..166..116D
2003, Nov 12	Apollo NEA 65803 Didymos (1996 GT, $H = 18.1$ mag, $D \approx 800 + 160$ m, PHA) passed Earth at 18.69 LD (= 0.05 AU). Minimum miss distance 18.69 LD. Flyby target for AIDA mission. See: 65803 Didymos - SSA , 1996 GT - JPL See also: https://en.wikipedia.org/wiki/65803_Didymos See also: 29 May 2012, 4 Oct 2022, 20 Oct 2062, 4 Nov 2123
2003, Dec	A. Boattini, G. D'Abramo, H. Scholl, O.R. Hainaut, R. West, G. Hahn, R. Michelsen, G. Forti, P. Pravec, G.B. Valsecchi, 2003, <i>Earth, Moon, and Planets</i>, 93, 239, "Eliminating virtual impactors

	with the Very Large Telescope: an ESO program with the FORS2 camera." See: http://adsabs.harvard.edu/abs/2003EM%26P...93..239B
2003, Dec	S.R. Chesley, A.W. Harris, D.K. Yeomans, S.N. Ward, 2003, <i>American Geophysical Union, Fall Meeting 2003</i> , abstract #P51E-01, "An updated assessment of the hazard due to Earth impacts." See: http://adsabs.harvard.edu/abs/2003AGUFM.P51E..01C
2003, Dec 5	S.R. Chesley, S.J. Ostro, D. Vokrouhlický, et al., 2003, <i>Science</i> , 302, 1739, "Direct detection of the Yarkovsky Effect by radar ranging to Apollo NEA 6489 Golevka ." See: http://adsabs.harvard.edu/abs/2003Sci...302.1739C See also: 6489 Golevka, 1991 JX , $H = 18.9$ mag, $D = 350 \times 250 \times 250$ m, PHA . 1991 JX -JPL , 6489 Golevka - SSA See also: http://www.spacegeneration.org/index.php/eventsttopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf https://en.wikipedia.org/wiki/6489_Golevka
2003, Dec 6	Apollo NEA 2003 XJ7 ($H = 26.1$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2003-05] See: 2003 XJ7 - JPL , 2003 XJ7 - SSA
2003, Dec 9	B.R. Blair, 2003, Research Paper, EB560 – Decision Analysis, Division of Economics and Business, Colorado School of Mines, "Decision model for potential asteroid impacts." See: http://www.digitalspace.com/projects/neo-mission/docs/Blair_ADM03.pdf
2003, Dec 22	Aten/Apollo NEA 2020 XC ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 4.13 LD. Minimum miss distance 0.94 LD. See: 2020 XC – S2P , 2020 XC – JPL See also: 30 May 2013, 30 Nov 2020 .
2004 , Jan 1	2608 NEAs known, of which 551 PHAs . See: http://neo.jpl.nasa.gov/stats/
2004	A. Cellino, K. Muinonen, E.F. Tedesco, 2004, <i>Advances in Space Research</i> , 33, 1576, "Rationale and orbital options for a dedicated space-based observatory for NEOs."

	See: http://adsabs.harvard.edu/abs/2004AdSpR..33.1576C
2004	R.A. Posner, 2004, <i>Catastrophe: risk and response</i> (Oxford: Oxford University Press). See: http://ukcatalogue.oup.com/product/9780195306477.do See also: http://www.hsaj.org/?article=4.1.5
2004	D. Sears, C. Allen, D. Britt, et al., 2004, <i>Advances in Space Research</i> , 34, 2270, "The Hera mission: multiple near-earth asteroid sample return." See: http://adsabs.harvard.edu/abs/2004AdSpR..34.2270S http://www.uark.edu/misc/hera/
2004	The international yearbook <i>Ephemerides of minor planets</i> (EMP), published since 1948 for the International Astronomical Union by the Institute of Applied Astronomy (IAA) in St. Petersburg (Russian Federation), contains information on orbital elements of numbered minor planets and the circumstances of their observations during the best observation periods. Starting in 2004 the IAA publishes the EMP in a reduced volume with information on a limited number of minor planets, together with a CD with data for all numbered planets. See: http://www.ipa.nw.ru/PAGE/DEPFUND/LSBSS/engephem.htm
2004, Jan	ESA international Near-Earth Object Mission Advisory Panel (NEOMAP) established. NEOMAP was charged with the task of advising ESA on cost-effective options for ESA participation in a space mission to contribute to our understanding of the physical nature of near-Earth asteroids and their terrestrial impact hazard. See: http://www.esa.int/SPECIALS/NEO/SEM4Q7OVGJE_0.html
2004	H. Dypvik, A. Mørk, M. Smelror, et al., 2004, <i>Norwegian Journal of Geology</i> , 84(3), 143, "Impact breccia and ejecta from the Mjølner crater in the Barents Sea - The Ragnarok Formation and Sindre Bed." See: http://www.geologi.no/cgi-bin/geologi/imaker?id=4333&visdybde=2&aktiv=4333 http://www.geologi.no/data/f/0/05/01/9_22301_0/Dypvik http://folk.uio.no/ftsikala/mjolnir/
2004, Jan 4	Villabeto de la Peña superbolide (Villabeto, Spain). Chondrite meteorites found. Ref: - J. Llorca, J.M. Trigo-Rodríguez, J.L. Ortiz, et al., 2005, <i>Meteoritics & Planetary Science</i> , 40, 795, "The Villalbeto de la Peña meteorite fall : I. Fireball energy, meteorite recovery, strewn field, and

	petrography." See: http://adsabs.harvard.edu/abs/2005M%26PS...40..795L - J.M. Trigo-Rodríguez, J. Boroviča, P. Spurný, et al., 2006, <i>Meteoritics & Planetary Science</i>, 41, 505, "The Villalbeto de la Peña meteorite fall: II. Determination of atmospheric trajectory and orbit." See: http://adsabs.harvard.edu/abs/2005M%26PS...41..505T See also: http://www.spmn.uji.es/ENG/presentation.html
2004, Jan 13	Apollo NEA 444004 (2004 AS1, $H = 20.8$, $D \approx 250$ m, PHA) discovered and initially thought to be heading for potential (10-25%) Earth impact within 24 hours. Questions were raised re who should be notified and whether or not such notice should be raised to [US] Presidential level. Fortunate late telescopic view by amateur astronomer in the UK found that NEO not on impact trajectory. Czech observation following night demonstrated that the asteroid passed Earth on 16 February 2004 at 33.2 LD. See: 2004 AS1 - JPL , 2004 AS1 - SSA Ref: - B.G. Marsden, 2007, in: P. Bobrowsky & H. Rickman (eds.), 2007, <i>Comet/Asteroid Impacts and Human Society</i> (Berlin: Springer), p. 505, "Impact risk communication management (1998 – 2004): Has it improved?" See: http://adsabs.harvard.edu/abs/2007caih.book....B See also: http://www.planetarydefense.info/resources/pdf/chapman.pdf http://b612foundation.org/papers/Chapman_AIAA.pdf http://en.wikipedia.org/wiki/2004_AS1
2004, Feb 23-26	2004 Planetary Defense Conference, Protecting Earth from Asteroids, Garden Grove (CA, USA), sponsored by the American Institute of Aeronautics and Astronautics (AIAA) and The Aerospace Corporation. Summary in White Paper. See: http://www.planetarydefense.info/ http://www.planetarydefense.info/resources/pdf/conference_white_paper.pdf http://www.aero.org/conferences/planetdef http://www.usatoday.com/tech/news/2004-03-11-asteroid-menace_x.htm
2004, Feb 23	C.R. Chapman, 2004, presented at AIAA 2004 Planetary Defense Conference <i>Protecting Earth from Asteroids</i>, Garden Grove (CA, USA), "NEO impact scenarios." See: http://www.b612foundation.org/papers/Chapman_AIAA.pdf
2004, Feb 23	D.K. Lynch, G.E. Peterson, 2004, presented at AIAA 2004 Planetary Defense Conference <i>Protecting Earth from Asteroids</i>, Garden Grove

	(CA, USA), "Athos, Porthos, Aramis, & D'Artagnon: four planning scenarios for planetary protection." See: http://www.planetarydefense.info/resources/pdf/lynch.pdf
2004, Mar	R.P. Binzel, E. Perozzi, A.S. Rivkin, A. Rossi, A.W. Harris, S.J. Bus, G.B. Valsecchi, S.M. Slivan, 2004, <i>Meteoritics & Planetary Science</i> , 39, 351, "Dynamical and compositional assessment of near-Earth object mission targets." See: http://adsabs.harvard.edu/abs/2004M%26PS...39..351B
2004, Mar	P. Jenniskens, 2004, <i>WGN, Journal of the International Meteor Organization</i> , 32, 7, " 2003 EH1 and the Quadrantid shower ." See: https://ui.adsabs.harvard.edu/abs/2004JIMO...32....7J/abstract See also: https://www.space.com/quadrantid-meteor-shower-2020-peaks-what-to-expect.html
2004, Mar	S.J. Ostro, L.A.M. Benner, M.C. Nolan, et al., 2004, <i>Meteoritics & Planetary Science</i> , 39, 407, "Radar observations of asteroid 25143 Itokawa (1998 SF36) ." See: http://adsabs.harvard.edu/abs/2004M%26PS...39..407O
2004, Mar	K. Petreshock, D. Abbott, C. Glatz, 2004, in: <i>35th Lunar and Planetary Science Conference</i> , 15-19 March 2004, League City (TX, USA), abstract no.1364, "Continental impact debris in the Eltanin impact layer." See: http://adsabs.harvard.edu/abs/2004LPI....35.1364P
2004, Mar 1	Apollo NEA 2017 EA ($H = 31.0$ mag, $D \approx 2.3$ m) passed Earth at a nominal miss distance of 1.10 LD. Minimum miss distance 0.66 LD. See: 2017 EA – SSA , 2017 EA – JPL
2004, Mar 18	Aten NEA 2004 FH ($H = 26.3$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 0.128 LD. Minimum miss distance 0.128 LD. [2004-01] See: 2004 FH - JPL , 2004 FH - SSA See also: http://neo.jpl.nasa.gov/news/news142.html http://antwarp.gsfc.nasa.gov/apod/ap040322.html http://en.wikipedia.org/wiki/2004_FH
2004, Mar 25	A. La Spina, P. Paolicchi, A. Kryszczyńska, P. Pravec, 2004, <i>Nature</i> , 428, 400, "Retrograde spins of near-Earth asteroids from the Yarkovsky effect." See: http://adsabs.harvard.edu/abs/2004Natur.428..400L
2004, Mar 27	Apollo NEA 2004 FY15 ($H = 26.2$ mag, $D \approx 20$ m) passed Earth at a

	nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2004-02] See: 2004 FY15 - JPL , 2004 FY15 - SSA
2004, Mar 31	Aten NEA 2004 FU162 ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.034 LD (= 2.03 R_{Earth} from the geocenter). Minimum miss distance 0.0090 LD (= 0.54 R_{Earth} from the geocenter). [2004-03] See: 2004 FU162 - JPL , 2004 FU162 - SSA See also: http://neo.ssa.esa.int/newsletters [June 2020] https://en.wikipedia.org/wiki/2004_FU162
2004, Apr	The Catalina Sky Survey brings a 0.5 m Schmidt telescope on-line at Siding Spring (Australia) for a southern hemisphere NEO search effort. See: http://uanews.org/node/23277
2004, Apr 7	NASA astronauts Russell L. Schweickart and Ed T. Lu on deflecting NEAs, testimony before the U.S. Senate Subcommittee on Science, Technology and Space, dealing with defense against asteroid impacts. See: http://www.globalsecurity.org/space/library/congress/2004_h/040407-schweickart.htm
2004, Apr 7	Apollo NEA 2008 GF1 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 2.06 LD. Minimum miss distance 0.25 LD. See: 2008 GF1 - JPL , 2008 GF1 - SSA See also: 7 Apr 2008 .
2004, Apr 18	Apollo NEA 2004 HE ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.72 LD. [2004-04] See: 2004 HE - JPL , 2004 HE - SSA
2004, May	A. Boattini, G. D'Abramo, H. Scholl, et al., 2004, <i>Astronomy & Astrophysics</i> , 418, 743, "Near Earth Asteroid search and follow-up beyond 22nd magnitude. A pilot program with ESO telescopes." See: http://adsabs.harvard.edu/abs/2004A%26A...418..743B
2004, May	J.L. Remo, 2004, <i>Acta Astronautica</i> , 54, 755, "A quantitative NEO hazard mitigation scale." See: http://adsabs.harvard.edu/abs/2004AcAau..54..755R
2004, May	Stokes, G., 2004, American Geophysical Union, Spring Meeting 2004, abstract #P11A-03, "A study to determine the feasibility of

	extending the search for NEOs to smaller limiting diameters: report of a NASA Science Definition Team." See: http://adsabs.harvard.edu/abs/2004AGUSM.P11A..03S
2004, May 15	C.R. Chapman, 2004, <i>Earth and Planetary Science Letters</i>, 222, 1, "The hazard of Near-Earth Asteroid impacts on Earth." See: http://adsabs.harvard.edu/abs/2004E%26PSL.222....1C See also: http://www.b612foundation.org/press/press.html , #5, http://www.sciencemag.org/content/304/5674/1081.1.full?sid=7557ae29-dd09-49f2-8140-b0fc461e288d
2004, May 25	A. Cheng, 2004, <i>Space Daily</i>, 25 May 2004, "One giant leap on an asteroid." See: http://www.spacedaily.com/news/asteroid-04f.html
2004, May 27-30	Meeting on Asteroids and Comets in Europe, Fraso Sabino (Italy). See: http://www.ara.roma.it/eng/div/specials.htm
2004, Jun	Nordic Near-Earth Object Network (NEON) started operations with the Nordic Optical Telescope on La Palma (Canary Islands, Spain), running till September 2006. Ref: - K. Muinonen, J. Torpa, J Virtanen, et al., 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symp. No. 236 on <i>Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i>, Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 309, "Spins, shapes and orbits for near-Earth objects by Nordic NEON." See: http://adsabs.harvard.edu/abs/2007IAUS..236..309M
2004, Jun 4	L. Becker, R.J. Poreda, A.R. Basu, et al., 2004, <i>Science</i>, 304, 1469, "Bedout, a possible end-Permian impact crater offshore of Northwestern Australia." See: http://www.sciencemag.org/content/304/5676/1469.abstract?sid=78e2e4f7-3397-4d09-b789-98f4799cf917
2004, Jun 19	Aten NEA 99942 Apophis (2004 MN4), $H = 19.0$ mag, $D = 310 \pm 30$ m, $M \approx 4.7 \times 10^{10}$ kg, orbital $P = 0.89$ yr, PHA) discovered, initially considered a serious impact probability. See: 2004 MN4 - JPL , 99942 Apophis - SSA Ref: - A.M. MacRobert, 15 February 2005, <i>Sky & Telescope</i>, "Asteroid 2004 MN4: a really near miss!" See: http://adsabs.harvard.edu/abs/2005S%26T...109e..16M - D. Chandler, 2005, <i>New Scientist</i>, 25 June 2005, issue 2505, "Killer

	asteroid: too close for comfort." See: http://www.newscientist.com/article/mg18625051.200-killer-asteroid-too-close-for-comfort.html - B.G. Marsden, 2007, in: P. Bobrowsky & H. Rickman (eds.), 2007, <i>Comet/Asteroid Impacts and Human Society</i> (Berlin: Springer), p. 505, "Impact risk communication management (1998 – 2004): Has it improved?" See: http://adsabs.harvard.edu/abs/2007caih.book....B - J.D. Giorgini, L. Benner, S.J. Ostro, et al., 2008, <i>Icarus</i>, 193, 1, "Predicting the Earth encounters of (99942) Apophis." See: http://adsabs.harvard.edu/abs/2008Icar..193....1G - S.R. Chesley, A. Milani, D. Tholen, et al., 2009, AAS-DPS, 41.4306, "An updated assessment of the impact threat from 99942 Apophis." See: http://adsabs.harvard.edu/abs/2009DPS....41.4306C - J. Žižka, D. Vokrouhlický, 2011, <i>Icarus</i>, 211, 511, "Solar radiation pressure on (99942) Apophis." See: http://adsabs.harvard.edu/abs/2011Icar..211..511Z - M. Brozovic, L. Benner, J. McMichael, et al., 2015, AAS DPS meeting #47, #402.06, "Size estimate of (99942) Apophis based on radar imaging." See: http://adsabs.harvard.edu/abs/2015DPS....4740206B See also: http://neo.jpl.nasa.gov/news/news164.html http://neo.jpl.nasa.gov/apophis/ http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2332 http://www.newscientist.com/article/mg18625051.200-killer-asteroid-too-close-for-comfort.html http://www.unoosa.org/pdf/pres/stsc2010/tech-45.pdf http://content.usatoday.com/communities/sciencefair/post/2010/11/apophis-asteroid-2013/1 See also: http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis http://en.wikipedia.org/wiki/99942_Apophis See also: 13 Apr 1907, 14 Apr 1949, 14 Apr 1998, 9 Jan 2013, 13 Apr 2029, 23 Mar 1936, 11 Sep 2059.
2004, Jun 25	J.K. Beatty, 2004, <i>Sky & Telescope</i>, "Killer asteroids: the count rises." See: http://www.skyandtelescope.com/news/3304491.html?page=1&c=y
2004, Jun 26	Apollo NEA 25143 Itokawa (1998 SF36, $H = 19.1$ mag, $D = 0.520 \times 0.270 \times 0.230$ km, $M = 3.6 \times 10^{10}$ kg, PHA) passed Earth at a nominal miss distance of 5.02 LD. Minimum miss distance 5.02 LD. See: 1998 SF36 - JPL , 25143 Itokawa - SSA See also: http://en.wikipedia.org/wiki/25143_Itokawa See also: 27 Jun 1905, 9 Apr 2167.

2004, Jul 9	ESA report <i>The Near-Earth Object Impact Hazard: Space Mission Priorities for Risk Assessment and Reduction</i>, recommendations to ESA by the Near-Earth Object Mission Advisory Panel (NEOMAP), by A.W. Harris, W. Benz, A. Fitzsimmons, A. Galvez, S.F. Green, P. Michel, and G.B. Valsecchi. See : http://www.esa.int/gsp/NEO/doc/NEOMAP_report_June23_wCover.pdf
2004, Jul 9	A Cosmic Study by the International Academy of Astronautics, final report "The next steps in exploring deep space", advocating <i>inter alia</i> the exploration of Near Earth Asteroids by human spaceflight. See: http://www.lpi.usra.edu/lunar/strategies/AdvisoryGroupReports/iaa_report.pdf
2004, Jul 15	P.R. Heck, B. Schmitz, H. Baur, A.N. Halliday, R. Wieler, 2004, <i>Nature</i>, 430, 323, "Fast delivery of meteorites to Earth after a major asteroid collision." See: http://adsabs.harvard.edu/abs/2004Natur.430..323H
2004, Jul 16	Apollo NEA 2004 OD4 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2004-05] See: 2004 OD4 - JPL , 2004 OD4 - SSA
2004, Aug	R.P. Binzel, A.S. Rivkin, J.S. Stuart, et al., 2004, <i>Icarus</i>, 170, 259, "Observed spectral properties of near-Earth objects: results for population distribution, source regions, and space weathering processes." See: http://adsabs.harvard.edu/abs/2004Icar..170..259B
2004, Aug	J.S. Stuart, R.P. Binzel, 2004, <i>Icarus</i>, 170, 295, "Bias-corrected population, size distribution, and impact hazard for the near-Earth objects." See: http://adsabs.harvard.edu/abs/2004Icar..170..259B
2004, Aug	D.J. Scheeres, F. Marzari, A. Rossi, 2004, <i>Icarus</i>, 170, 312, "Evolution of NEO rotation rates due to close encounters with Earth and Venus." See: http://adsabs.harvard.edu/abs/2004Icar..170..312S
2004, Aug 6	Apollo NEA 2004 QB, $H = 19.8$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 4.29 LD. Minimum miss distance 4.29 LD. See: 2004 QB - JPL , 2004 QB - SSA

2004, Aug-Nov	N. Peter, A. Barton, D. Robinson, J.M. Salotti, 2004, <i>Acta Astronautica</i> , 55, 325, "Charting response options for threatening Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2004AcAau..55..325P 559
2004, Aug 12	Perseid Fireball over Japan. See: http://apod.nasa.gov/apod/ap040813.html
2004, Aug 19	Aten NEA 367943 Duende (2012 DA14 , $H = 24.2$ mag, $D \approx 40 \times 20$ m) passed Earth at a nominal miss distance of 3.16 LD. Minimum miss distance 3.16 LD. See: 2012 DA14 - JPL , 367943 Duende - SSA See also: http://en.wikipedia.org/wiki/2012_DA14 See also: 17 Feb 1918 , 16 Feb 2012 , 15 Feb 2013 , 15 Feb 2046 , 15 Feb 2087 .
2004, Aug 24	Aten NEA 2004 QA22 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 2.47 LD. Minimum miss distance 2.46 LD. See: 2004 QA22 - JPL , 2004 QA22 - SSA
2004, Aug 31 - Sep	IAU Colloquium No. 197 on Dynamics of Populations of Planetary Systems , Belgrado (Serbia & Montenegro). Proceedings: Z. Knežević & A. Milani (eds.), 2005, <i>Dynamics of Populations of Planetary Systems</i> (Cambridge: CUP). See: http://adsabs.harvard.edu/abs/2005dpaps.conf.....K
2004, Sep 4	Antarctica Fireball and Airburst . United States Department of Defense (DoD) space-based infrared sensors detected a large meteor in flight at an altitude of approximately 75 km at on 3 September 2004 at latitude 67.72° S, longitude 16.89° E. Space-based Department of Energy (DoE) visible light sensors also detected the fireball. The emissive debris trail from the fireball extended from 56 – 18 km altitude and remained detectable at infrared wavelengths owing to solar scattering for over an hour. Two distinct disintegration features were visible along the path, at 32 km and 25 km altitude. Initial mass estimate $M \approx 0.6 \times 10^6$ kg, energy release $E \approx 13$ kT of exploding TNT). The original solar orbit of the body is similar to near-Earth asteroids of the Aten group. See: http://www.antarctica.gov.au/_data/assets/pdf_file/0010/22213/0520cosmic20hole20in20one.pdf http://en.wikipedia.org/wiki/List_of_meteor_air_bursts Ref: - A.R. Klekociuk, P.G. Brown, D.W. Pack, et al., 2005, <i>Nature</i> , 436, 1132, "Meteoritic dust from the atmospheric disintegration of a large meteoroid".

	See: http://adsabs.harvard.edu/abs/2005Natur.436.1132K
2004, Sep 13	Apollo NEA 2004 RU109 ($H = 26.4$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.96 LD. [2004-06] See: 2004 RU109 - JPL , 2004 RU109 - SSA
2004, Sep 21	Apollo NEA 2004 ST26 ($H = 26.1$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.95 LD. [2004-07] See: 2004 ST26 - JPL , 2004 ST26 - SSA
2004, Sep 26	Apollo NEA 2016 TT ($H = 26.1$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 0.67 LD. Minimum miss distance 0.64 LD. [2004-08] See: 2016 TT - JPL , 2016 TT - SSA
2004, Sep 29	Apollo NEA 4179 Toutatis (1989 AC , $H = 15.2$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, orbital $P = 4.03$ yr, the largest known PHA) passed Earth at a nominal miss distance of 4.03 LD. Minimum miss distance 4.03 LD. See: 1989 AC - JPL , 4179 Toutatis - SSA See also: http://echo.jpl.nasa.gov/asteroids/4179_Toutatis/toutatis.html http://www.space.com/scienceastronomy/toutatis_video_040929.html#video http://antwrp.gsfc.nasa.gov/apod/ap041001.html http://antwrp.gsfc.nasa.gov/apod/ap041002.html http://www.planetary.org/news/2004/0927_Very_Close_Approach_by_Asteroid_4179.html http://www.planetary.org/news/2004/0929_Simultaneous_Observations_of_Asteroid.html http://en.wikipedia.org/wiki/4179_Toutatis See also: 8 Dec 1992, 30 Nov 1996, 31 Oct 2000, 9 Nov 2008, 12 Dec 2012, 5 Nov 2069.
2004, Oct	NASA Meteoroid Environment Office , established in October 2004, at NASA Marshall Space Flight Center, Huntsville (AL, USA). The office set up the NASA All-sky Fireball Network . See: http://www.nasa.gov/offices/meo/home/aboutMEO-rd.html http://fireballs.ndc.nasa.gov/
2004, Oct	American Institute of Aeronautics and Astronautics (AIAA), Position Paper <i>Protecting Earth from Asteroids and Comets</i> . See: http://pdf.aiaa.org/downloads/publicpolicypositionpapers//Asteroids-Final.pdf http://www.planetarydefense.info/resources/pdf/Asteroids-Final.pdf
2004, Oct 2	Aten NEA 2016 TQ54 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a

	nominal miss distance of 1.80 LD. Minimum miss distance 0.13 LD. See: 2016 TQ54 - JPL , 2016 TQ54 - SSA
2004, Oct 16	Apollo NEA 2017 UR2 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 5.01 LD. Minimum miss distance 0.018 LD (= 1.08 R_{Earth} from the geocenter) . See: 2017 UR2 - SSA , 2017 UR2 - JPL See also: 17 Oct 2017 .
2004, Oct 24	Aten NEA 2004 UH1 ($H = 28.4$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.77 LD. Minimum miss distance 0.77 LD. [2004-09] See: 2004 UH1 - JPL , 2004 UH1 - SSA See also: 24 Oct 1960 .
2004, Nov	D. Lazzaro, C.A. Angeli, J.M. Carvano, et al., 2004, <i>Icarus</i> , 172, 179, " S³OS² : the visible spectroscopic survey of 820 asteroids." See: http://adsabs.harvard.edu/abs/2004Icar..172..179L S³OS²: Small Solar System Objects Spectroscopic Survey – carried out at the ESO (La Silla, Chile). See also: http://sbn.psi.edu/pds/resource/s3os2.html
2004, Nov 27 – Dec 2	ICSU Workshop on NEOs in La Laguna (Tenerife, Spain), "Tenerife Retreat", supported by the 2004 ICSU/UNESCO Grant Programme, and co-sponsored by the IAU. Proceedings: P. Bobrowsky & H. Rickman (eds.), 2007, Comet/Asteroid Impacts and Human Society (Berlin: Springer). See: http://adsabs.harvard.edu/abs/2007caih.book.....B http://thelightofdayradioshow.com/.../Comet-Asteroid-Impacts-and-Human-Socie... See also: http://www.icsu.org/what-we-do/projects-activities/icsu-grants-programme/grant-summary-reports/?icsudocid=summary-2004 http://www-th.bo.infn.it/tunguska/ICSU_PARTICIPANTS_LIST.pdf
2004, Nov 26	E. Asphaug, 2004, <i>Science</i> , 306, 1489, "Nothing simple about asteroids." See: http://www.sciencemag.org/content/306/5701/1489.summary
2004, Dec	M.J.S. Belton, T.H. Morgan, N. Samarasinha & D.K. Yeomans (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP). See: http://adsabs.harvard.edu/abs/2004mhca.conf.....B http://cambridge.org/us/catalogue/catalogue.asp?isbn=9780521827645&ss=

	ind http://www.cambridge.org/gb/knowledge/isbn/item1170928/?site_locale=en_GB Abstracts: http://www.noao.edu/meetings/mitigation/eav.html
2004, Dec	M.D. Campbell-Brown, A. Hildebrand, 2004, <i>Earth, Moon, and Planets</i> , 95, 489, "A new analysis of fireball data from the Meteorite Observation and Recovery Project (MORP) ." See: http://adsabs.harvard.edu/abs/2004EM%26P...95..489C
2004, Dec	D. Morrison, C.R. Chapman, D. Steel, R.P. Binzel, 2004, in: M.J.S. Belton, et al. (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 38, "The role of radar in predicting and preventing asteroid and comet collisions with Earth." See: http://adsabs.harvard.edu/abs/2004mhca.conf..353M
2004, Dec	S.J. Ostro, J.D. Giorgini, 2004, in: M.J.S. Belton, et al. (eds.), 2004, <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 353, "Impacts and the public: communicating the nature of impact hazard." See: http://adsabs.harvard.edu/abs/2004mhca.conf..38O
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2004, Dec 9	Aten NEA 2015 XT378 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 2.42 LD. Minimum miss distance 0.21 LD. See: 2015 XT378 - JPL , 2015 XT378 - SSA
2004, Dec 16	Apollo NEA 2004 XB45 ($H = 26.2$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 0.85 LD. Minimum miss distance 0.84 LD. [2004-10] See: 2004 XB45 - JPL , 2004 XB45 - SSA
2004, Dec 19	Apollo NEA 2004 YD5 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.088 LD (= 5.32 R_{Earth} from the geocenter). Minimum miss distance 0.088 LD. [2004-11] See: 2004 YD5 - JPL , 2004 YD5 - SSA See also: http://www.space.com/scienceastronomy/asteroid_close_041222.html
2004, Dec 24	Apollo NEA 184266 (2004 VW14) , $H = 19.3$ mag, $D \approx 500$ m, PHA) passed Earth at a nominal miss distance of 4.93 LD. Minimum miss

	distance 4.93 LD. See: 2004 VW14 - JPL , 2004 VW14 - SSA
2005, Jan 1	3146 NEAs known, of which 646 PHAs . See: http://neo.jpl.nasa.gov/stats/
2005	T. Kenkmann, F. Hörz, A. Deutsch (eds.), 2005, Proceedings Large meteorite impacts III , <i>Geological Society of America Special Papers</i> , Vol. 384. See: http://specialpapers.gsapubs.org/content/384
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2005, Jan	M.C. Nolan, L.A. Benner, G. Black, et al., 2005, in: O. Engvold (ed.), <i>Highlights of Astronomy</i> , 13, 759, as presented at the XXVth General Assembly of the IAU , Sydney (Australia), 13 - 26 July 2003 (San Francisco: ASP), "Radar observations of Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/2005HiA....13..759N
2005, Jan	P. Pravec, A.W. Harris, P. Scheirich, et al., 2005, <i>Icarus</i> , 173, 108, "Tumbling asteroids." See: http://adsabs.harvard.edu/abs/2005Icar..173..108P
2005, Jan 7	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) , <i>Information on research in the field of NEOs carried out by Member States, international organizations and other entities</i> . See: http://www.unoosa.org/pdf/reports/ac105/AC105_839E.pdf
2005, Jan 13	Apollo NEA 2005 BS1 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.68 LD. Minimum miss distance 0.68 LD. [2005-01] See: 2005 BS1 - JPL , 2005 BS1 - SSA
2005, Feb 21- Mar	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) , Scientific and Technical Subcommittee, 42nd Session, Action Team 14 on NEOs meets in Vienna (Austria), during the 42 nd session of the Scientific & Technical Subcommittee of UN-COPUOS . Report 25 February 2005. Hans Rickman, former IAU General Secretary, presents paper "Comet/Asteroid Impacts and Human Society". The Planetary Defense Center of Lavochkin Association, Moscow (Russia) presents a proposal "Creation of the

	'Citadel' International Planetary Defense System." Report: http://www.unoosa.org/pdf/reports/ac105/AC105_848E.pdf See also: http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_863Add1E.pdf
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2005, Feb 15	A.M. MacRobert, 15 February 2005, <i>Sky & Telescope</i>, "Asteroid 2004 MN4: a really near miss!" See: http://www.skyandtelescope.com/news/3310036.html?page=1&c=y
2005, Mar 5	H. Rickman, former IAU General Secretary, 2005, in: A. Heck (ed.), 2006, <i>Organizations and Strategies in Astronomy</i>, Vol. 6 (Dordrecht: Springer), p. 225, "IAU initiatives relating to the Near Earth Object impact hazard." See: http://adsabs.harvard.edu/abs/2006ASSL..335..225R
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2005, Mar 18	Aten NEA 2005 FN ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.37 LD. Minimum miss distance 0.37 LD. [2005-02] See: 2005 FN - JPL , 2005 FN - SSA
2005, Apr	P. Michel, A. Morbidelli, W.F. Bottke, 2005, <i>Comptes Rendus – Physique</i>, 6, 291, "Origin and dynamics of Near Earth Objects." See: http://adsabs.harvard.edu/abs/2005CRPhy...6..291M
2005, Apr	W. Thuillot, J. Vaubaillon, H. Scholl, 2005, <i>Comptes Rendus - Physique</i>, 6, 327, "Relevance of the NEO dedicated observing programs." See: http://adsabs.harvard.edu/abs/2005CRPhy...6..327T
2005, Apr 13	Apollo NEA 2018 GD2 ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 9.84 LD. Minimum miss distance 0.79 LD. 2018 GD2 - SSA , 2018 GD2 - JPL See also: 12 Apr 2018, 15 Oct 2065.
2005, May 20	R.L. Schweickart, 2005, presented at the National Space Society <i>International Space Development Conference</i>, Washington (DC, USA), "A call to (considered) action". See: http://www.b612foundation.org/papers/Call_for_Action.pdf

	See also: http://www.thespacereview.com/article/384/1
2005, May 26	R. Gomes, H.F. Levison, K. Tsiganis, A. Morbidelli, 2005, <i>Nature</i> , 435, 466, "Origin of the cataclysmic Late Heavy Bombardment period of the terrestrial planets." See: http://adsabs.harvard.edu/abs/2005Natur.435..466G
2005, May 31	J. Foust, <i>The Space Review</i> , 31 May 2005, "Sounding an alarm, cautiously." See: http://www.thespacereview.com/article/384/1
2005, Jun	G.S. Collins, H.J. Melosh, R.A. Marcus, 2005, <i>Meteoritics & Planetary Science</i> , 40, 817, "Earth impact effects program: a web-based computer program for calculating the regional environmental consequences of a meteoroid impact on Earth." See: http://adsabs.harvard.edu/abs/2005M%26PS...40..817C http://www.lpl.arizona.edu/impacteffects/ http://www.lpl.arizona.edu/impacteffects/CollinsEtAl2005.pdf
2005, Jun 6 – Oct 1	Exchange of letters between B612 Foundation and NASA Administrator re the potential need for a near-term launch of a mission to Apophis (2004 MN4) to precisely determine its orbit in order to permit an orderly deflection mission should it, in fact, be on an impact trajectory. See: http://www.b612foundation.org/press/press.html #11.
2005, Jun 10	Aten NEA 2018 UC ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 8.50 LD. Minimum miss distance 0.92 LD. 2018 UC - SSA , 2018 UC - JPL See also: 30 Oct 1941 .
2005, Jul	Vredefort crater , located in the Free State Province of South Africa, and named after the town of Vredefort situated near its centre, is the largest verified impact crater on Earth. The site is also referred to as Vredefort dome or Vredefort impact structure. In 2005, the Vredefort Dome was added to the list of UNESCO World Heritage Sites for its geologic interest. The asteroid that hit the Vredefort area in pre-historic times is one of the largest to ever impact Earth (at least since the Hadean), with an estimated diameter of $D > 10$ km. The crater has a diameter $d \approx 250 - 300$ km, larger than the 200 km wide Sudbury Basin crater and the 170 km wide Chicxulub crater . This makes Vredefort the largest known impact structure on Earth. The age is estimated to be $2,023 \pm 4$ million years, impacting during the Paleoproterozoic era. Ref: - E.P. Turtle, E. Pierazzo, D.P. O'Brien, 2003, <i>Meteoritics &</i>

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2005, Jul 4	NASA spacecraft Deep Impact collided with comet 9P/Tempel. See: http://www.nasa.gov/pdf/474723main_Johnson-DI_Lessons_Learned_for_NOW.ppt.pdf http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-367 http://en.wikipedia.org/wiki/Deep_Impact_(space_mission)
2005, Jul 20	E. Asphaug, 2005, <i>Nature</i>, 436, 335, "Asteroids: shaken on impact." See: http://adsabs.harvard.edu/abs/2005Natur.436..335A
2005, Aug	M. Čuk, J.A. Burns, 2005, <i>Icarus</i>, 176, 418, "Effects of thermal radiation on the dynamics of binary NEAs." See: http://adsabs.harvard.edu/abs/2005Icar..176..418C
2005, Aug 7-12	IAU Symposium No. 229 on Asteroids, Comets, Meteors, IX, Búzios (Rio de Janeiro, Brazil). Proceedings: D. Lazzaro, S. Ferraz-Mello & J.A. Fernández (eds.), 2006, <i>Asteroids, Comets, Meteors 2005</i> (Cambridge: CUP). See: http://journals.cambridge.org/action/displayIssue?jid=IAU&volumeId=1&issueId=S229
2005, Aug 7	R.P. Binzel, D.F. Lupishko, 2006, in: D. Lazzaro, S. Ferraz-Mello & J.A. Fernández (eds.), Proc. IAU Symposium No. 229 on <i>Asteroids, Comets, Meteors, IX</i>, Búzios (Rio de Janeiro, Brazil), 7-12 Aug 2005 (Cambridge: CUP), p. 207, "Properties of the Near-Earth object population: the ACM 2005 view." See: http://adsabs.harvard.edu/abs/2006IAUS..229..207B

2005, Aug 7	S.R. Chesley, 2006, in: D. Lazzaro, S. Ferraz-Mello & J.A. Fernández (eds.), Proc. IAU Symposium No. 229 on <i>Asteroids, Comets, Meteors, IX</i> , Búzios (Rio de Janeiro, Brazil), 7-12 Aug 2005 (Cambridge: CUP), p. 215, "Potential impact detection for Near-Earth asteroids: the case of 99942 Apophis (2004 MN4) ." See: http://adsabs.harvard.edu/abs/2006IAUS..229..215C http://www.b612foundation.org/papers/Chesley_paper.pdf
2005, Aug 13	Spaceguard Survey progress: 3496 NEAs known, of which 793 with $D > 1$ km.
2005, Aug 25	A.R. Klekociuk, P.G. Brown, D.W. Pack, et al., 2005, <i>Nature</i> , 436, 1132, "Meteoritic dust from the atmospheric disintegration of a large meteoroid." See: http://adsabs.harvard.edu/abs/2005Natur.436.1132K
2005, Sep	M.J. Gaffey, P.A. Abell, P.S. Hardersen, et al., 2005, in: Proc. <i>68th Annual Meeting of the Meteoritical Society</i> , 12-16 September 2005, Gatlinburg (TN, USA), <i>Meteoritics & Planetary Science</i> , 40, Supplement, p.5127, "Compositions of binary Near-Earth Objects: implications for the meteorite flux." See: http://adsabs.harvard.edu/abs/2005M%26PSA..40.5127G
2005, Sep	D.T. King, L.W. Petruny, 2005, in: Proc. <i>68th Annual Meeting of the Meteoritical Society</i> , 12-16 September 2005, Gatlinburg (TN, USA), <i>Meteoritics & Planetary Science</i> , 40, Supplement, p.5317, "The stratigraphic and historic record of meteoritic impact events in Alabama." See: http://adsabs.harvard.edu/abs/2005M%26PSA..40.5317K
2005, Sep 25	ESA selected two target asteroids for its NEO deflection mission concept Don Quijote , under study by ESA's Advanced Concepts Team (ACT). In February 2005 ESA's NEO Mission Advisory Panel (NEOMAP) submitted a target selection report for Europe's future asteroid mitigation missions, identifying the relevant criteria for selecting a target and picking two objects that meet most of those criteria: asteroid 10302 (1989 ML) , $H = 19.5$ mag, $D = 500$ m, Amor asteroid) and asteroid 2002 AT4 ($H = 20.9$ mag, $D = 160 \times 370$ m, Amor asteroid). Three industrial phase-A studies were completed in September 2007. See: http://www.esa.int/esaCP/SEML9B8X9DE_index_0.html http://www.esa.int/SPECIALS/NEO/SEMZRZNVGJE_0.html http://www.esa.int/SPECIALS/NEO/SEM3P4OVGJE_0.html http://www.esa.int/SPECIALS/NEO/SEMVXVB1S6F_0.html http://en.wikipedia.org/wiki/Don_Quijote_(space_probe)

	http://www.nasa.gov/pdf/474203main_Coradini_ExploreNOW.pdf http://www.spacegeneration.org/index.php/eventstopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf
2005, Sep - Oct	R.L. Schweickart, C.R. Chapman, 2005, <i>American Scientist</i> , 93, 392, "Better collision insurance - asteroids smaller than those now being actively catalogued constitute a largely neglected natural hazard."
2005, Oct	D.J. Asher, M. Bailey, V. Emel'yanenko, W. Napier, 2005, <i>The Observatory</i> , 125, 319, "Earth in the cosmic shooting gallery." See: http://adsabs.harvard.edu/abs/2005Obs...125..319A
2005, Oct 10	Apollo NEA 2005 TK50 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.35 LD. Minimum miss distance 0.23 LD. [2005-03] See: 2005 TK50 - JPL , 2005 TK50 - SSA
2005, Oct 10-14	The Association of Space Explorers (ASE), at its XIX Congress in Salt Lake City (Utah, USA), formed the ASE Committee on Near-Earth Objects (chair Russell L. Schweickart), and charged it with bringing to the attention of world leaders and key international institutions the threat of asteroid impacts to life on Earth. An Open Letter elaborates on the issue. See: http://www.space-explorers.org/committees/NEO/docs/ASE_intro_AT-14.pdf http://www.space-explorers.org/committees/NEO/docs/Open_Letter.pdf
2005, Oct 16	Apollo NEA 2017 BG92 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 2.88 LD. Minimum miss distance 0.62 LD. See: 2017 BG92 – SSA , 2017 BG92 – JPL
2005, Oct 30	Apollo NEA 2005 UW5 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2005-04] See: 2005 UW5 - JPL , 2005 UW5 - SSA
2005, Nov	H. Fu, R. Jedicke, D.D. Durda, et al., 2005, <i>Icarus</i> , 178, 434, "Identifying near-Earth object families." See: http://adsabs.harvard.edu/abs/2005Icar..178..434F
2005, Nov	D.P. O'Brien, R. Greenberg, 2005, <i>Icarus</i> , 178, 179, "The collisional and dynamical evolution of the main-belt and NEA size distributions." See: http://adsabs.harvard.edu/abs/2005Icar..178..179O

2005, Nov	V.V. Svetsov, 2005, <i>Planetary and Space Science</i> , 53, 1205, "Numerical simulations of very large impacts on the Earth." See: http://adsabs.harvard.edu/abs/2005P%26SS...53.1205S
2005, Nov 1	Taurid Meteor shower over Cerro Pachon (Chile). See: http://apod.nasa.gov/apod/ap051115.html
2005, Nov 10	E.T. Lu, S.G. Love, 2005, <i>Nature</i> , 438, 177: " Gravitational tractor for towing asteroids", an article describing how a spacecraft could deflect an Earth-bound asteroid without having to dock to its surface. See: http://adsabs.harvard.edu/abs/2005Natur.438..177L http://www.b612foundation.org/press/press.html #12.
2005, Nov 19, 25	Japan Aerospace Exploration Agency (JAXA) spacecraft Hayabusa (formerly MUSES-C), launched 9 May 2003, lands on Apollo NEA 25143 Itokawa (1998 SF36 , $H = 19.1$ mag, $D = 535 \times 290 \times 209$ m, $M = 3.6 \times 10^{10}$ kg, PHA). The first rendezvous mission to a PHA . Sample return to Earth in June 2010. JAXA is considering a Hayabusa2 sample return mission to Apollo NEA 162173 Ryugu (1999 JU3 , $H = 19.5$ mag, $D \approx 870$ m, PHA). See: http://www.isas.ac.jp/e/enterp/missions/hayabusa/index.shtml http://en.wikipedia.org/wiki/Hayabusa https://en.wikipedia.org/wiki/25143_Itokawa Ref: - I. Fuyuno, 2005, <i>Nature</i> , 438, 542, " Hayabusa ready to head home with asteroid sample." See: http://adsabs.harvard.edu/abs/2005Natur.438..542F - E. Asphaug, 2006, <i>Science</i> , 312, 1328, "Adventures in Near-Earth Object exploration." See: http://adsabs.harvard.edu/abs/2006Sci...312.1328A http://www.ipsubc.org/paper/1328.pdf - A. Fujiwara, et al., 2006, <i>Science</i> , 312, 1327, " Hayabusa at asteroid Itokawa ." See: http://www.sciencemag.org/content/312/5778.toc - A. Fujiwara, J. Kawaguchi, D.K. Yeomans, et al., <i>Science</i> , 312, 1330, "The rubble-pile asteroid Itokawa as observed by Hayabusa ." See: http://adsabs.harvard.edu/abs/2006Sci...312.1330F - J. Saito, H. Miyamoto, R. Nakamura, et al., 2006, <i>Science</i> , 312, 1341, "Detailed images of asteroid 25143 Itokawa from Hayabusa ." See: http://adsabs.harvard.edu/abs/2006Sci...312.1341S - H. Yano, T. Kubota, H. Miyamoto, et al., 2006, <i>Science</i> , 312, 1350, "Touchdown of the Hayabusa spacecraft at the Muses Sea on Itokawa ."

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2005, Nov 23	Workshop Near Earth Objects, a Natural Hazard of Global Proportions, London (UK), hosted by the Royal Aeronautical Society. See: http://www.raes.org.uk/conference/PDFs/520.pdf http://www.spaceref.com/news/viewpr.html?pid=18431
2005, Nov 26	Apollo NEA 2005 WN3 ($H = 30.2$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.22 LD. Minimum miss distance 0.22 LD. [2005-05] See: 2005 WN3 - JPL , 2005 WN3 - SSA
2005, Dec	C.S. Cockell, P. Lee, P. Broady, 2005, <i>Meteoritics & Planetary Science</i>, 40, 1901, "Effects of asteroid and comet impacts on habitats for lithophytic organisms – a synthesis." See: http://adsabs.harvard.edu/abs/2005M%26PS...40.1901C
2005, Dec 5	Apollo NEA 2005 XA8 ($H = 25.8$ mag, $D \approx 24$ m) passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.56 LD.

	[2005-06] See: 2005 XA8 - JPL , 2005 XA8 - SSA
2005, Dec 22	US Congress passed Section 321 of the NASA Authorization Act of 2005 (Public Law No. 109-155), a.k.a. the "George E. Brown Jr NEO Survey Act" (in honour of US Congressman G. E. Brown, 1920 – 1999), charging NASA to detect, track and characterize 90% of NEOs with $D > 140$ m that could potentially strike Earth, by the end of 2020. Aim probably not reached before 2028. See: http://www.govtrack.us/congress/billtext.xpd?bill=s109-1281 http://en.wikipedia.org/wiki/Planetary_defense#cite_note-morrison_1992-1
2006, Jan 1	3775 NEAs known, of which 741 PHAs. See: http://neo.jpl.nasa.gov/stats/
2006	A. Cellino, R. Somma, L. Tommasi, et al., 2006, <i>Advances in Space Research</i>, 37, 153, "NERO: general concept of a Near-Earth Object radiometric observatory." See: http://adsabs.harvard.edu/abs/2006AdSpR..37..153C
2006	J. de León, J. Licandro, R. Duffard, M. Serra-Ricart, 2006, <i>Advances in Space Research</i>, 37, 178, "Spectral analysis and mineralogical characterization of 11 olivine pyroxene rich NEAs." See: http://adsabs.harvard.edu/abs/2006AdSpR..37..178D
2006	C. Koeberl, 2006, in: W.U. Reynolds & R.L. Gibson (eds.), <i>Processes on the Early Earth, Geological Society of America, Special Papers</i>, 405, 1, "The record of impact processes on the early Earth: a review of the first 2.5 billion years." See: http://specialpapers.gsapubs.org/content/405/1.abstract
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2006, Jan	H. Rickman, 2006, in: A. Heck (ed.), <i>Organizations and Strategies in Astronomy</i>, Vol. 6, p. 225 (Dordrecht: Springer), "IAU initiatives relating to the Near-Earth Object impact hazard." See: http://adsabs.harvard.edu/abs/2006ASSL..335..225R
2006, Jan	R.W. Sinnott, 2006, <i>Sky & Telescope</i>, 111, no.1, p. 132, "How large an asteroid could a person jump off?" See: http://adsabs.harvard.edu/abs/2006S%26T...111a.132S
2006, Jan	K.J. Walsh, D.C. Richardson, 2006, <i>Icarus</i>, 180, 201, "Binary near-

	Earth asteroid formation: rubble pile model of tidal disruptions." See: http://adsabs.harvard.edu/abs/2006Icar..180..201W
2006, Jan 12	E. Asphaug, C.B. Agnor, Q. Williams, 2006, <i>Nature</i> , 439, 155, "Hit-and-run planetary collisions." See: http://adsabs.harvard.edu/abs/2006Natur.439..155A
2006, Jan 27, 29, 30	Arecibo radar observations of Aten NEA 99942 Apophis (2004 MN4) , $H = 19.1$ mag, $D = 310 \pm 30$ m, $M \approx 4.7 \times 10^{10}$ kg, orbital $P = 0.89$ yr, PHA) by Steven J. Ostro. See: 2004 MN4 - JPL , 99942 Apophis - SSA See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=1253 http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis http://en.wikipedia.org/wiki/99942_Apophis
2006, Jan 28	Apollo NEA 2006 BV39 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.88 LD. [2006-01] See: 2006 BV39 - JPL , 2006 BV39 - SSA
2006, Jan 29	Apollo NEA 2006 BF56 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.53 LD. Minimum miss distance 0.53 LD. [2006-02] See: 2006 BF56 - JPL , 2006 BF56 - SSA
2006, Feb	G. Beekman, 2006, <i>Journal for the History of Astronomy</i> , 37, 71, "I.O. Yarkovsky and the discovery of 'his' effect." See: http://adsabs.harvard.edu/abs/2006JHA....37...71B
2006, Feb 16	Apollo NEA 2020 QN4 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 4.92 LD. Minimum miss distance 0.58 LD. See: 2020 QN4 – S2P , 2020 QN4 - JPL See also: 21 Aug 2020, 21 Feb 2050.
2006, Feb 18	Apollo NEA 2020 DA1 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 4.41 LD. Minimum miss distance 0.14 LD. See: 2020 DA1 – S2P , 2020 DA1 - JPL See also: 18 Feb 2020.
2006, Feb 20	The Committee on the Peaceful Uses of Outer Space (UN-COPUOS) . Pursuant to paragraph 16 of UN General Assembly resolution 61/111 of 14 December 2006, the UN-COPUOS Scientific and Technical Subcommittee , at its 670th meeting, on 20 February, established a Working Group on Near-Earth Objects for one year under the chairmanship of Richard Tremayne-Smith (UK).

	See: http://www.unoosa.org/pdf/reports/ac105/AC105_890E.pdf Annex III http://www.space-explorers.org/committees/NEO/docs/ASE_Intervention.pdf
2006, Feb 20	R.L. Schweickart, 2006, presentation to the Royal Aeronautical Society & CCLRC, Rutherford Appleton Laboratory (U.K.), 20 February 2006, "Near-Earth Asteroids: deciding to deflect." See: http://www.space-explorers.org/committees/NEO/neo.html
2006, Feb 23	Apollo NEA 2006 DD1 ($H = 26.4$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 0.31 LD. Minimum miss distance 0.31 LD. [2006-03] See: 2006 DD1 - JPL , 2006 DD1 - SSA
2006, Feb 24	Aten NEA 2006 DM63 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.60 LD. Minimum miss distance 0.59 LD. [2006-04] See: 2006 DM63 - JPL , 2006 DM63 - SSA
2006, Mar	P. Pravec, P. Scheirich, P. Kušnirák, et al., 2006, <i>Icarus</i>, 181, 63, "Photometric survey of binary near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2006Icar..181...63P
2006, Mar	S.P. Wright, M.A. Vesconi, A. Gustin, 2006, presented at <i>37th Annual Lunar and Planetary Science Conference</i>, 13-17 March 2006, League City (TX, USA), abstract no.1102, "Revisiting the Campo Del Cielo Crater Field (Argentina): a new data point from a natural laboratory of multiple low velocity, oblique impacts." See: http://adsabs.harvard.edu/abs/2006LPI....37.1102W Read also: - M.C.L. Rocca, September 2006, presented at <i>Proc. 69th Annual Meeting of the Meteoritical Society</i>, 6-11 August 2006, Zürich (Switzerland), <i>Meteoritics & Planetary Science</i>, 41, Supplement, p. 5001, "A catalogue of large meteorite specimens from Campo Del Cielo Meteorite shower, Cahco Province (Argentina)." See: http://adsabs.harvard.edu/abs/2006M%26PSA..41.5001R - P. Bobrowsky & H. Rickman (eds.), 2007, <i>Comet/asteroid impacts and human society</i> (Berlin: Springer), p. 30, "Campo del Cielo, Argentina." See: http://adsabs.harvard.edu/abs/2007caih.book....B The Campo del Cielo Meteorites refers to a group of iron meteorites or to the area where they were found situated on the border between the provinces of Chaco and Santiago del Estero, 1,000 kilometers NW of Buenos Aires (Argentina). The crater field covers an area of 3×20 km and contains at least 26 craters, the largest being 115×91 m. The craters' age is estimated as 4,000 – 5,000 years. The craters, containing iron

	masses, were reported in 1576, but were already well known to the aboriginal inhabitants of the area. The craters and the area around contain numerous fragments of an iron meteorite. The total weight of the pieces so far recovered exceeds 100 tonnes, making the meteorite the heaviest one ever recovered on Earth. The largest fragment, consisting of 37 tonnes, is the second heaviest single-piece meteorite recovered on Earth, after the Hoba Meteorite (see: June 1967). See also: http://www.lpi.usra.edu/meetings/lpsc2006/pdf/1102.pdf http://www.lpi.usra.edu/meetings/metsoc2006/pdf/5001.pdf http://en.wikipedia.org/wiki/Campo_del_Cielo
2006, Mar 1-2	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Scientific and Technical Subcommittee, 43rd Session, Action Team 14 on NEOs meets in Vienna (Austria). Report 16 March 2006: http://www.unoosa.org/pdf/reports/ac105/AC105_869E.pdf
2006, Mar 3	In December 1932, scientists surveying the southern Egyptian desert came upon pieces of a translucent, pale yellow-green, glassy substance, from tiny fragments to football-sized chunks, scattered over a huge area at the Libyan border. Known as Libyan Desert Glass, this almost pure silica contained isotopes showing it to be of extraterrestrial origin. But scientists had not been able to figure out where it came from. Now Farouk El-Baz, director of the Boston University Center for Remote Sensing, believes the mystery has been solved. On satellite images of the Sahara Desert, he found a gigantic impact crater in the area. At a diameter of 30 km, it's "the largest crater yet found in the Sahara," El-Baz says, and big enough to be the source of the glass, which covers a 60- by 100-km area. He believes the crater hadn't been recognized before because it is so big; also, parts of its rims were eroded by two ancient river systems. El-Baz has named the crater, located on the Gifl Kebir plateau, the Kebira. Ref: - N.N., 2006, <i>Science</i>, 311, 1223, "Glass with an impact." See: http://www.sciencemag.org/content/311/5765/1223.2.full.pdf - K. Floor, E. Echternach, 2006, <i>Zenit</i>, September 2006, p. 404, "Het is rond en het... . Inslagkraters op satellietbeelden." See: http://www.dekoepel.nl/zenit/september2006.html http://keesfloor.nl/artikelen/zenit/2006pdf/kraters.pdf - L. Orti, M. di Martino, M. Morelli, et al., 2008, <i>Meteoritics & Planetary Science</i>, 43, 1629, "Non-impact origin of the crater-like structures in the Gifl Kebir area (Egypt): implications for the geology of eastern Sahara." See: http://adsabs.harvard.edu/abs/2008M%26PS...43.1629O - G.R. Osinski, J. Kieniewics, J.R. Smith, M.B.E. Boslough, et al., 2008, <i>Meteoritics & Planetary Science</i>, 43, 2089, "The Dakhleh Glass: product of an impact airburst or cratering event in the Western

	Desert of Egypt?" See: http://adsabs.harvard.edu/abs/2008M%26PS...43.2089O See also: http://www.sciencemag.org/cgi/content/summary/311/5765/1223c http://www.planetary.org/news/2006/0303_Egyptian_Impact_Site_Possible_Source.html http://www.wits.ac.za/newsroom/newsitems/201310/21649/news_item_21649.html http://en.wikipedia.org/wiki/Kebira_crater http://en.wikipedia.org/wiki/Libyan_desert_glass
2006, Mar 8	Apollo NEA 2006 EC ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.70 LD. [2006-05] See: 2006 EC - JPL , 2006 EC - SSA See also: 11 March 2063.
2006, Mar 20	B. Peiser, 2006, <i>The Space Review</i>, 20 March 2006, "Asteroid turns hot potato: when NEO risk communication becomes uncommunicative." See: http://www.thespacereview.com/article/581/1
2006, Mar 20	B.G. Marsden, 2006, <i>The Space Review</i>, 20 March 2006, "2004 VD17, impact assessment scales, and a natural impact warning clearinghouse." See: http://www.thespacereview.com/article/581/2 See also: 7 November 2041.
2006, Mar 29	Earth-grazing fireball, travelling in 30 seconds about 1000 km, 71 km above Japan. Estimated mass $M \approx 100$ kg. Ref: - S. Abe, J. Borovička, P. Spurný, et al., 2006, Proc. <i>European Planetary Science Congress 2006</i>, Berlin (Germany), 18-22 September 2006, "Earth-grazing fireball on March 29, 2006." See: http://adsabs.harvard.edu/abs/2006epsc.conf..486A http://en.wikipedia.org/wiki/Earth-grazing_fireball
2006, Mar 31	Aten NEA 2021 FW2 ($H = 25.4$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 3.10 LD. Minimum miss distance 0.16 LD. See: 2021 FW2 - S2P , 2021 FW2 – JPL See also: 31 March 2064.
2006, Apr	P.A. Bland, N.A. Artemieva, 2006, <i>Meteoritics</i>, 41, 607, "The rate of small impacts on Earth." See: http://adsabs.harvard.edu/abs/2006M%26PS...41..607B
2006, Apr 24	Apollo NEA 2020 HX3 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a

	nominal miss distance of 4.36 LD. Minimum miss distance 0.34 LD. See: 2020 HX3 – S2P , 2020 HX3 - JPL See also: 24 Apr 2020 . See: also: https://www.space.com/house-size-asteroid-2020-gh2-earth-flyby-april-2020.html
2006, Apr 26-28	International Conference on Near-Earth Objects Hazard: Knowledge and Action , Belgirate (Italy).
2006, May	W.F. Bottke, A. Morbidelli, 2006, in: <i>Workshop on Surface Ages and Histories: Issues in Planetary Chronology</i> , Houston (TX, USA), 23 May 2006, <i>LPI Contribution</i> No. 1320, "The asteroid and comet impact flux in the terrestrial planet region: a brief history of the last 4.6 Gy." See: http://adsabs.harvard.edu/abs/2006LPICo1320...18B
2006, May	W.F. Bottke, D. Vokrouhlický, D.P. Rubincam, D. Nesvorný, 2006, <i>Annual Review of Earth and Planetary Sciences</i> , 34, 157, "The Yarkovsky and YORP effects: implications for asteroid dynamics." See: http://adsabs.harvard.edu/abs/2006AREPS..34..157B
2006, May 8-12	40th ESLAB Symposium, 1st International Conference on Impact Cratering in the Solar System , Noordwijk (the Netherlands), 8-12 May 2006. See: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=37662
2006, May 10	Apollo NEA 2006 JY26 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 1.13 LD (and the Moon at 0.38 LD). Minimum miss distance 1.13 LD (and the Moon at 0.38 LD). See: 2006 JY26 - JPL , 2006 JY26 - SSA Ref: - R. Brasser, P. Wiegert, 2008, <i>Monthly Notices Royal Astronomical Society</i> , 386, 2931, "Asteroids on Earth-like orbits and their origin." See: http://adsabs.harvard.edu/abs/2008MNRAS.386.2031B See also: http://fromthegonzo.wordpress.com/2006/05/12/asteroid-impact-effects/ https://en.wikipedia.org/wiki/2006_JY26 See also: 3 May 2074 .
2006, May 11	W.D. Maier, M.A.G. Andreoli, I. McDonald, et al., 2006, <i>Nature</i> , 441, 203, "Discovery of a 25-cm asteroid clast in the giant Morokweng impact crater , South Africa." See: http://adsabs.harvard.edu/abs/2006Natur.441..203M
2006, May 12	R. Irion, 12 May 2006, <i>Science</i> , 312, 840, "A Hawaiian upstart prepares to monitor the starry heavens."

	See: http://www.sciencemag.org/content/312/5775/840.summary/
2006, May 12-14	Meeting on <i>Asteroids and Comets in Europe</i> , Vienna (Austria). See: http://www.astrometrica.at/MACE/abstracts.html
2006, May 28	Aten NEA 2020 KJ4 ($H = 29.9$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 2.12 LD. Minimum miss distance 0.17 LD. See: 2020 KJ4 – S2P , 2020 KJ4 – JPL See also: 28 May 2020 .
2006, Jun	W.N. Edwards, P.G. Brown, D.O. Reville, 2006, <i>Journal of Atmospheric and Solar-Terrestrial Physics</i> , 68, 1136, "Estimates of meteoroid kinetic energies from observations of infrasonic airwaves." See: http://adsabs.harvard.edu/abs/2006JASTP..68.1136E
2006, Jun	R. Kahle, G. Hahn, E. Kührt, 2006, <i>Icarus</i> , 182, 482, "Optimal deflection of NEOs en route of collision with the Earth." See: http://adsabs.harvard.edu/abs/2006Icar..182..482K
2006, Jun	A. Morbidelli, M. Gounelle, H.F. Levison, W.F. Bottke, 2006, <i>Meteoritics & Planetary Science</i> , 41, 874, "Formation of the binary near-Earth object 1996 FG3 : can binary NEOs be the source of short-CRE meteorites?" See: http://adsabs.harvard.edu/abs/2006M%26PS...41..874M
2006, Jun 2	E. Asphaug, 2006, <i>Science</i> , 312, 1328, "Adventures in Near-Earth Object exploration." See: http://adsabs.harvard.edu/abs/2006Sci...312.1328A http://www.ipsubc.org/paper/1328.pdf
2006, Jun 9	Establishment of EUROpean Near Earth Asteroid Research (EURONEAR) , a network for follow-up of NEAs/PHAs using 1-2 m class telescopes in Europe by professionals, students and amateurs. Ref: - F. Colas, M. Birlan, O. Vaduvescu, et al., 2006, presented at the <i>American Astronomical Society, DPS meeting #38, #58.05; Bulletin of the American Astronomical Society</i> , 38, 592, " EURONEAR - First Results at Pic du Midi." See: http://adsabs.harvard.edu/abs/2006DPS....38.5805C - O. Vaduvescu, M. Birlan, F. Colas, et al., 2008, <i>Planetary and Space Science</i> , 56, 1913, " EURONEAR : first results." See: http://adsabs.harvard.edu/abs/2008P%26SS...56.1913V - A. Tudorica, R. Toma, A.B. Sonka, et al., 2009, <i>American Astronomical Society, DPS meeting #40, #27.09; Bulletin of the American Astronomical Society</i> , 41, 557, " EURONEAR - the first 100 NEA's observed."

	See: http://adsabs.harvard.edu/abs/2009DPS....40.2709T - O. Vaduvescu, L. Curelaru, M. Birlan, 2009, <i>Astronomische Nachrichten</i>, 330, 698, "EURONEAR: data mining of asteroids and Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2009AN....330..698V - M. Birlan, O. Văduvescu, D.A. Nedelcu, EURONEAR Team, 2010, <i>Romanian Astronomical Journal</i>, 20, Supplement "Recent insights into our Universe", 119, "High-precision astrometry of NEAs via EURONEAR observations." See: http://adsabs.harvard.edu/abs/2010RoAJ...20S.119B - M. Birlan, O. Vaduvescu, A. Tudorica, et al., 2010, <i>Astronomy & Astrophysics</i>, 511, 40, "More than 160 near Earth asteroids observed in the EURONEAR network." See: http://adsabs.harvard.edu/abs/2010A%26A...511A..40B - O. Vaduvescu, M. Birlan, A. Tudorica, et al., 2011, <i>Planetary and Space Science</i>, 59, 1632, "EURONEAR – recovery, follow-up and discovery of NEAs and MBAs using large field 1-2m telescopes." See: http://adsabs.harvard.edu/abs/2011P%26SS...59.1632V See also: http://euronear.imcce.fr/tiki-index.php?page=HomePage https://en.wikipedia.org/wiki/EURONEAR
2006, Jun 26-29	<i>NASA Workshop on Near-Earth Object Detection, Characterization, and Threat Mitigation</i>, Vail (CO, USA). Proceedings: <i>NEO Survey and Deflection Analysis of Alternatives: Report to Congress</i>, issued March 2007. See: http://neo.jpl.nasa.gov/neo/report2007.html http://www.nasa.gov/pdf/171331main_NEO_report_march07.pdf http://www.hq.nasa.gov/office/pao/FOIA/NEO_Analysis_Doc.pdf Among the papers: - R. Schweickart, C. Chapman, D. Durda, B. Bottke, D. Nesvorny, P. Hut 2006, e-print <i>arXiv:physics/0608155</i>, "Threat characterization: trajectory dynamics." See: http://www.b612foundation.org/papers/wp_dynamics.pdf http://www.b612foundation.org/papers/dynamics.pdf http://adsabs.harvard.edu/abs/2006physics...8155S - R. Schweickart (B612 Foundation), C. Chapman, D. Durda, P. Hut, 2006, e-print <i>arXiv:physics/0608156</i>, "Threat mitigation: the Asteroid Tugboat." See: http://adsabs.harvard.edu/abs/2006physics...8156S - R. Schweickart (B612 Foundation), C. Chapman, D. Durda, P. Hut, 2006, e-print <i>arXiv:physics/0608157</i>, "Threat mitigation: the Gravity Tractor." See: http://adsabs.harvard.edu/abs/2006physics...8157S

2006, Jul	S.R. Chesley, S.N. Ward, 2006, <i>Natural Hazards</i>, 38, 355, "A quantitative assessment of the human and economic hazard from impact-generated tsunami." See: http://www.es.ucsc.edu/~ward/papers/tsunami_(v43).pdf See also: http://www.newscientist.com/article/dn9160-tsunami-risk-of-asteroid-strikes-revealed.html
2006, Jul	D.P. O'Brien, R. Greenberg, J.A. Richardson, 2006, <i>Icarus</i>, 183, 79, "Craters on asteroids: reconciling diverse impact records with a common impacting population." See: http://adsabs.harvard.edu/abs/2006Icar..183...79O
2006, Jul 3	Apollo NEA 2004 XP14 ($H = 19.8$ mag, $D \approx 260$ m, PHA) passed Earth at a nominal miss distance of 1.12 LD. Minimum miss distance 1.12 LD. See: 2004 XP14 - JPL , 2004 XP14 - SSA Ref: - M.W. Busch, S.R. Kulkarni, A.R. Conrad, P.B. Cameron, 2007, <i>Icarus</i>, 189, 589, "Keck adaptive optics imaging of near-Earth asteroid 2004 XP14." See: http://adsabs.harvard.edu/abs/2007Icar..189..589B See also: http://en.wikipedia.org/wiki/2004_XP14
2006, Jul 16	J. Davis, P. Singla, J. Junkins, 2006, presented at the <i>7th International Conference on Dynamics and Control of Systems and Structures in Space (DCSSS)</i>, London (England), 16-20 July 2006, "Identifying near-term missions and impact keyholes for asteroid 99942 Apophis." See: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.188.4573
2006, Jul 23	Apollo NEA 2006 OK3 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.73 LD. [2006-06] See: 2006 OK3 - JPL , 2006 OK3 - SSA
2006, Aug	R. Schweickart, C. Chapman, D. Durda, B. Bottke, D. Nesvorny, P. Hut, 2006, presented at NASA Workshop on <i>Near-Earth Object Detection, Characterization, and Threat Mitigation</i>, Vail (CO, USA), 26-29 Jun 2006, White Paper 040, "Threat characterization: trajectory dynamics." See: http://adsabs.harvard.edu/abs/2006physics...8155S http://www.b612foundation.org/papers/wpAT.pdf http://www.b612foundation.org/papers/AT-GT.pdf

2006, Aug	R. Schweickart, C. Chapman, D. Durda, P. Hut, 2006, presented at NASA Workshop on <i>Near-Earth Object Detection, Characterization, and Threat Mitigation</i>, Vail (CO, USA), 26-29 Jun 2006, White Paper 041, "Threat mitigation: the Asteroid Tugboat." See: http://adsabs.harvard.edu/abs/2006physics...8156S http://www.b612foundation.org/papers/wpAT.pdf http://www.b612foundation.org/papers/AT-GT.pdf
2006, Aug	R. Schweickart, C. Chapman, D. Durda, P. Hut, 2006, presented at NASA Workshop on <i>Near-Earth Object Detection, Characterization, and Threat Mitigation</i>, Vail (CO, USA), 26-29 Jun 2006, White Paper 042, "Threat mitigation: the Gravity Tractor." See: http://adsabs.harvard.edu/abs/2006physics...8157S http://www.b612foundation.org/papers/wpGT.pdf http://www.b612foundation.org/papers/AT-GT.pdf
2006, Aug	D. Morrison, 2006, <i>Philosophical Transactions Royal Society A</i>, 364, 2041, "Asteroid and comet impacts: the ultimate environmental catastrophe." See: http://adsabs.harvard.edu/abs/2006RSPTA.364.2041M http://rsta.royalsocietypublishing.org/content/364/1845/2041.full.pdf+html
2006, Aug	First asteroid discovered by the La Sagra Sky Survey (LSSS), of the Observatorio Astronomico de La Sagra (OLS), Puebla de Don Fadrique (Andalusia, Spain), operated by the Observatorio Astronomico de Mallorca (OAM). The LSSS employs three 45cm f/2.8 telescopes. Since 2009, LSSS is the most prolific European NEO survey. As of Spring 2012, the LSSS has submitted more than 1,000,000 observations of asteroids and comets to the Minor Planet Center (MPC) and the LSSS has been credited with over 6,000 asteroid discoveries, including 52 NEOs. See: http://www.minorplanets.org/OLS/ http://lasagraskysurvey.org/index.html http://lasagraskysurvey.org/neoslist.html
2006, Aug 14	As a follow-up of the IAU Working Group on Near Earth Objects (WG-NEO), the IAU EC appointed an IAU Advisory Committee on Hazards of Near Planetary Objects. Membership: six IAU Division III asteroid scientists. See: http://www.iau.org/science/scientific_bodies/working_groups/125/
2006, Aug 14-18	IAU Symposium No. 236 on Near Earth Objects, our Celestial Neighbours: Opportunity and Risk, Prague (Czech Republic).

	Proceedings: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), 2007 (Cambridge: CUP). See: http://journals.cambridge.org/action/displayIssue?jid=IAU&volumeId=2&issueId=S236 http://adsabs.harvard.edu/abs/2007IAUS..236.....V
2006, Aug 18	B.G. Marsden, 2006, <i>Dissertatio cum Nuncio Siderio III</i> (IAU XXVI General Assembly journal), No. 5, p. 1, "Defenestrace." See: http://astro.cas.cz/nuncius/nsiii_05.pdf
2006, Aug 23	Aten NEA 2019 AU6 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 2.31 LD. Minimum miss distance 0.98 LD. See: 2019 AU6 - JPL , 2019 AU6 - SSA
2006, Aug 24	Brian G. Marsden retired as director of the IAU Minor Planet Center (Cambridge, MA, USA), to be succeeded by Timothy B. Spahr. See: http://www.cfa.harvard.edu/iau/mpc.html
2006, Aug 31	Apollo NEA 2006 QM111 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.41 LD. [2006-07] See: 2006 QM111 - JPL , 2006 QM111 - SSA
2006, Sep	P.A. Bland, P. Spurný, A.W.R. Bevan, et al., 2006, in: Proceedings <i>69th Annual Meeting of the Meteoritical Society</i>, 6-6-11 August 2006, Zürich (Switzerland), <i>Meteoritics & Planetary Science</i>, 41, Supplement, p.5197, "First Light for the Desert Fireball Network." See: http://adsabs.harvard.edu/abs/2006M%26PSA..41.5197B
2006, Sep	F. Colas, M. Birlan, O. Vaduvescu, et al., 2006, presented at the <i>American Astronomical Society, DPS meeting #38, #58.05</i>; <i>Bulletin of the American Astronomical Society</i>, 38, 592, "EURONEAR - First Results at Pic du Midi." See: http://adsabs.harvard.edu/abs/2006DPS....38.5805C
2006, Sep	J. de León, R. Duffard, J. Licandro, et al., 2006, <i>Bulletin of the American Astronomical Society</i>, 38, 627, "Near-Earth Objects Spectroscopic Survey (NEOSS): first results from mineralogical analysis." See: http://adsabs.harvard.edu/abs/2006DPS....38.7107D
2006, Sep	R. Duffard, J. de León, J. Licandro, D. Lazzaro, M. Serra-Ricart, 2006, <i>Astronomy & Astrophysics</i>, 456, 775, "Basaltic asteroids in the Near-Earth Objects population: a mineralogical analysis." See: http://adsabs.harvard.edu/abs/2006A%26A...456..775D

2006, Sep	T.J. Goldin, H.J. Melosh, 2006, in: <i>Proceedings 69th Annual Meeting of the Meteoritical Society</i> , Zürich (Switzerland), 6-11 August 2006, <i>Meteoritics & Planetary Science</i> , 41, Supplement, p.5073, "Effects of falling impact ejecta on the post- Chicxulub atmosphere." See: http://adsabs.harvard.edu/abs/2006M%26PSA..41.5073G
2006, Sep	A.K. Mainzer, 2006, <i>Bulletin of the American Astronomical Society</i> , 38, 568, " NEOCam : The Near-Earth Object Camera ." Proposal selected by NASA for technological development, 5 May 2011. See: http://adsabs.harvard.edu/abs/2006DPS....38.4509M See also: http://neocam.ipac.caltech.edu/ http://www.jpl.nasa.gov/news/news.cfm?release=2011-136&cid=release_2011-136&msource=11136&tr=y&auid=8299371
2006, Sep	G. Tancredi, 2006, <i>Meteoritics & Planetary Science</i> , 41, A5269, "A new fireball in early April: a possible association with the Prábram Radiant." See: http://adsabs.harvard.edu/abs/2006M%26PSA..41.5269T
2006, Sep 15	Expert Working Group on the Comet and Asteroid Hazard Problem established by the Space Council of the Russian Academy of Sciences. See: http://www.inasan.ru/eng/asteroid_hazard/ http://www.oosa.unvienna.org/pdf/limited/c1/AC105_C1_L295E.pdf http://www.unoosa.org/pdf/pres/stsc2010/tech-35.pdf
2006, Sep 18-22	European Planetary Science Congress 2006 (EPSC #1) , Berlin (Germany), 18-22 September 2006. See: http://meetings.copernicus.org/epsc2006/
2006, Oct	J.L. Ortiz, F.J. Aceituno, J.A. Quesada, 2006, <i>Icarus</i> , 184, 319, "Detection of sporadic impact flashes on the Moon: implications for the luminous efficiency of hypervelocity impacts and derived terrestrial impact rates." See: http://adsabs.harvard.edu/abs/2006Icar..184..319O
2006, Oct 2	First light of the China NEO Survey Telescope (NEOST) , located at Xuyi Station of Purple Mountain Observatory (Nanjing, China). NEOST , is the the best performing telescope in fields of Near Earth Object survey and optical imaging in China. NEOST is a f/1.8 Schmidt type telescope with a 1.20 m primary mirror and a 1.04 m corrector. Its 4K by 4K CCD camera provides a FoV of 3.8 sq.d. Up to August 2012, the China NEO Survey (CNEOS) program has observed 149971 asteroids with more than 530 thousands

	observations, found 1279 new provisional designation asteroids, and catalogued 251 numbered asteroids (including 5 Jupiter trojans, 2 Hildas, 1 Phocaea). The CNEOS program has obtained 824 NEO position observations and found 4 new NEOs, including one Apollo type NEO, 2007 JW2, and three Amor type NEOs, 2009 MZ6, 2007 RT147, 2007 QX14. (priv.comm., August 2012) See also: http://english.pmo.cas.cn/rh/dcm/nsb/200908/t20090831_35079.html Ref: - R. Stone, 2008, <i>Science</i>, 319, 1326, "Preparing for doomsday." See: http://www.sciencemag.org/content/319/5868/1326.summary/
2006, Oct	P. Vereš, L. Kornoš, J. Tóth, 2006, <i>Contributions Astronomical Observatory Skalnaté Pleso</i>, 36 (3), 171, "Search for very close approaching NEAs." See: http://adsabs.harvard.edu/abs/2006CoSka..36..171V
2006, Oct 5-6	Workshop on Spacecraft Reconnaissance of Asteroid and Comet Interiors, Santa Cruz (CA, USA), 5-6 October 2006. See: http://www.lpi.usra.edu/meetings/recon2006/
2006, Oct 7	Apollo NEA 2006 RZ, $H = 20.6$ mag, $D \approx 270$ m, PHA) passed Earth at a nominal miss distance of 4.99 LD. Minimum miss distance 4.99 LD. See: 2006 RZ- JPL , 2006 RZ - SSA
2006, Oct 8 15.57	Apollo NEA 2019 TM3 ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 2.50 LD. Minimum miss distance 0.99 LD. See: 2019 TM3 – SSA , 2019 TM3 - JPL
2006, Oct 21	Apollo NEA 2006 UE64 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [2006-08] See: 2006 UE64 - JPL , 2006 UE64 - SSA
2006, Oct 30	Apollo NEA 2006 UJ185 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.695 LD. Minimum miss distance 0.694 LD. [2006-09] See: 2006 UJ185 - JPL , 2006 UJ185 - SSA
2006, Oct-Dec	A. Debus, 2006, <i>Acta Astronautica</i>, 59, 1093, "Planetary protection: elements for cost minimization." See: http://adsabs.harvard.edu/abs/2006AcAau..59.1093D
2006, Nov	D.D. Durda, 2006, <i>Sky & Telescope</i>, November 2006, p. 29, "The most dangerous asteroid ever found."

	See: http://adsabs.harvard.edu/abs/2006S%26T...112e..28D
2006, Nov 16	Apollo NEA 2006 WP1 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.81 LD. Minimum miss distance 0.80 LD. [2006-10] See: 2006 WP1 - JPL , 2006 WP1 - SSA
2006, Nov 20	Apollo NEA 2006 WX29 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.86 LD. Minimum miss distance 0.85 LD. [2006-11] See: 2006 WX29 - JPL , 2006 WX29 - SSA
2006, Nov 21	Apollo NEA 2006 WV ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2006-12] See: 2006 WV - JPL , 2006 WV - SSA
2006, Nov 22	Asteroid 2017 KB3 ($H = 25.1$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 6.80 LD. Minimum miss distance 0.76 LD. See: 2017 KB3 - JPL , 2017 KB3 - SSA
2006, Nov 24	D.J. Scheeres, E.G. Fahnestock, S.J. Ostro, J.-L. Margot, et al., 2006, <i>Science</i> , 314, 1280, "Dynamical configuration of binary Near-Earth Asteroid (66391) 1999 KW4 ." See: http://adsabs.harvard.edu/abs/2006Sci...314.1280S
2006, Nov 24	S.J. Ostro, J.-L. Margot, L.A.M. Benner, J.D. Giorgini, et al., 2006, <i>Science</i> , 314, 1276, "Radar imaging of binary Near-Earth Asteroid (66391) 1999 KW4 ." See: http://adsabs.harvard.edu/abs/2006Sci...314.1276O
2006, Dec 12	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) Action Team 14: Interim Report. See: http://www.oosa.unvienna.org/pdf/limited/c1/AC105_C1_L290E.pdf http://www.unoosa.org/pdf/pres/stsc2007/tech-35.pdf
2006, Dec 28	NASA <i>Near-Earth Object Survey and Deflection Study</i> , Final report. See: http://www.hq.nasa.gov/office/pao/FOIA/NEO_Analysis_Doc.pdf http://neo.jpl.nasa.gov/neo/report2007.html
2007, Jan 1	4412 NEAs known, of which 825 PHAs . See: http://neo.jpl.nasa.gov/stats/
2007	The 200,000 th minor planet was numbered at the IAU Minor Planet Center : asteroid 200000 (2007 JT40 , $H = 15.7$ mag, $D \approx 2.5$ km, main-belt asteroid), discovered on 12 May 2007 by the Mount

	Lemon Survey at Mount Lemmon (AZ, USA), as part of the Catalina Sky Survey .
2007	The Association of Space Explorers (ASE) formed an ASE Panel on Asteroid Threat Mitigation . See: http://www.space-explorers.org/committees/NEO/neo.html
2007	P. Bobrowsky & H. Rickman (eds.), 2007, Comet/Asteroid Impacts and Human Society (Berlin: Springer). Report of the "Tenerife Retreat" of December 2004. See: http://adsabs.harvard.edu/abs/2007caih.book....B http://thelightofdayradioshow.com/PlanetX_Files/Comet-Asteroid-Impacts-and-Human-Society.pdf Among the papers: - J. Andersen, 2007, p. 521, "Towards rational international policies on the NEO hazard." See: http://adsabs.harvard.edu/abs/2007caih.book....B - B.G. Marsden, 2007, p. 505, "Impact risk communication management (1998 – 2004): has it improved?" See: http://adsabs.harvard.edu/abs/2007caih.book....B - D. Morrison, 2007, p. 163, "The impact hazard: advanced NEO surveys and societal responses." See: http://adsabs.harvard.edu/abs/2007caih.book....B
2007	K.R. Evans, J.W. Horton, D.T. King, J.R. Morrow (eds.), 2007, Proc., The Sedimentary Record of Meteorite Impacts , <i>Geological Society of America Special Papers</i> , Vol. 437. See: http://specialpapers.gsapubs.org/content/437
2007	J.D. Koenig, C.F. Chyba, 2007, <i>Science & Global Security</i> , 15 (1), 57, "Impact deflection of potentially hazardous asteroids using current launch vehicles." See: http://scienceandglobalsecurity.org/archive/2007/05/impact_deflection_of_potential.html http://scienceandglobalsecurity.org/archive/sgs15koenig.pdf
2007	D.A. Kring, 2007, <i>LPI Contribution No. 1355</i> , "Guidebook to the Geology of Barringer Meteorite Crater, Arizona (a.k.a. Meteor Crater)." See: http://www.lpi.usra.edu/publications/books/barringer_crater_guidebook/
2007	A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symposium No. 236 on Near Earth Objects, our Celestial Neighbours: Opportunity and Risk , Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP).

	See: http://adsabs.harvard.edu/abs/2007neoo.book.....M Among the papers: - G.B. Valsecchi, 2007, <i>IAUS</i> 236, xvii, "236 years ago" See: http://adsabs.harvard.edu/abs/2007IAUS..236....V - S.J. Ostro, J.D. Giorgini, L.A.M. Benner, 2007, p <i>IAUS</i> 236, 143, "Radar reconnaissance of near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2007IAUS..236..143O - P. Pravec, A.W. Harris, B.D. Warner, 2007, <i>IAUS</i> 236, 167, NEA rotations and binaries." See: http://adsabs.harvard.edu/abs/2007IAUS..236..167P - D.F. Lupishko, M. Di Martino, R.P. Binzel, 2007, <i>IAUS</i> 236, 251, "Near-Earth objects as principal impactors of the Earth: physical properties and sources of origin." See: http://adsabs.harvard.edu/abs/2007IAUS..236..251L - A. Boattini, A. Milani, G.F. Gronchi, T. Spahr, G.B. Valsecchi, 2007, <i>IAUS</i> 236, p. 291, "Low solar elongation searches for NEO: a deep sky test and its implications for survey strategies." See: http://adsabs.harvard.edu/abs/2007IAUS..236..291B - S. Larson, 2007, <i>IAUS</i> 236, p. 323, "Current NEO surveys." See: http://adsabs.harvard.edu/abs/2007IAUS..236..323L - R.S. Mc Millan, <i>IAUS</i> 236, p. 329, "Spacewatch preparations for the era of deep all-sky surveys." See: http://adsabs.harvard.edu/abs/2007IAUS..236..329M - O. Engvold, IAU General Secretary, 2007, <i>IAUS</i> 236, p. 467, "The IAU role." See: http://adsabs.harvard.edu/abs/2007IAUS..236..467E
2007	L.D. Schmadel, 2007, <i>Dictionary of minor planet names</i> (Berlin: Springer). See: http://adsabs.harvard.edu/abs/2007dmpn.book.....S
2007, Jan	J. Licandro, H. Campins, T. Mothé-Diniz, et al., 2007, <i>Astronomy and Astrophysics</i>, 461, 751, "The nature of comet-asteroid transition object (3200) Phaethon." See: http://adsabs.harvard.edu/abs/2007A%26A...461..751L
2007, Jan 18	Aten NEA 2007 BD ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2007-01] See: 2007 BD - JPL , 2007 BD - SSA See also: 17 Jan 1965.
2007, Jan 19	Aten NEA 2007 BB ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 1.01 LD. Minimum miss distance 0.99 LD. See: 2007 BB - JPL , 2007 BB - SSA

2007, Feb 7	J.P. Sanchez Cuartielles, C. Colombo, M. Vasile, G. Radice, 2007, in: <i>New trends in astrodynamics and applications. III.</i> , AIP Conference Proceedings, 886, 317, "A multi-criteria assessment of deflection methods for dangerous NEOs." See: http://adsabs.harvard.edu/abs/2007AIPC..886..317S
2007, Feb 11	Apollo NEA 2007 CC27 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.86 LD. Minimum miss distance 0.86 LD. [2007-02] See: 2007 CC27 - JPL , 2007 CC27 - SSA
2007, Feb 11	D. Vergano, 2007, <i>USA Today</i> , "Near-Earth asteroids could be 'steppingstones to Mars '." See: http://www.usatoday.com/tech/science/space/2007-02-12-asteroid_x.htm
2007, Feb 21	Apollo NEA 2007 DN41 ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.79 LD. Minimum miss distance 0.78 LD. [2007-03] See: 2007 DN41 - JPL , 2007 DN41 - SSA
2007, Feb 21-22	UN Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Scientific and Technical Subcommittee, 44th Session, Action Team 14 on NEOs meets in Vienna (Austria). Action Team 14 recommends addressing the threat from smaller NEAs, augmentation of the Minor Planet Center , preparation of a draft NEA deflection protocol and international procedures. Report 6 March 2007: http://www.unoosa.org/pdf/reports/ac105/AC105_890E.pdf
2007, Feb 21	R.L. Schweickart, 2007, presented at the 44 th Session of the UN-COPUOS Scientific and Technical Subcommittee Meeting , Vienna (Austria), "Deflecting NEOs: a pending international challenge." See: http://www.space-explorers.org/committees/NEO/docs/STSC07paper.pdf
2007, Mar	D. Morrison, A. Milani, R. Binzel, et al., 2007, in: O. Engvold (ed.), <i>Reports on Astronomy</i> , IAU Transactions XXVIA (Cambridge: CUP), p. 187, "Division I & III WG on Near Earth Objects". See: http://adsabs.harvard.edu/abs/2007IAUTA..26..187M
2007, Mar	NASA, 2007, "Near-Earth Object survey and deflection analysis of alternatives. Report to Congress." See: https://www.nasa.gov/pdf/171331main_NEO_report_march07.pdf https://www.hq.nasa.gov/office/pao/FOIA/NEO_Analysis_Doc.pdf https://cneos.jpl.nasa.gov/doc/neo_report2007.html

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2007, Mar 5-8	International Academy of Astronautics (IAA) 2007 Planetary Defense Conference, Protecting Earth from Asteroids , Washington, D.C. (USA). Summary and recommendations in White Paper . See: http://www.aero.org/conferences/planetarydefense/ http://www.aero.org/conferences/planetarydefense/2007papers/WhitePaperFinal.pdf http://www.space-explorers.org/committees/NEO/docs/Intl_Policy_Issues.pdf
2007, Mar 5	R.L. Schweicart, 2007, presented at the International Academy of Astronautics (IAA) 2007 Planetary Defense Conference, Protecting Earth from Asteroids, Washington D.C. (USA), 5-8 March 2007, "The NEO threat: international policy issues". See: http://www.planetarydefense.info http://www.space-explorers.org/committees/NEO/docs/Intl_Policy_Issues.pdf
2007, Mar 7	NASA report to Congress <i>NEO Survey and Deflection Analysis of Alternatives – Report to Congress</i> , in response to the George E. Brown Jr NEO Survey Act of 28 December 2005. See: http://neo.jpl.nasa.gov/neo/report2007.html Critique: #15, #16 http://www.b612foundation.org/press/press.html
2007, Mar 11	Apollo NEA 2007 EH ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.46 LD. Minimum miss distance 0.46 LD. [2007-04] See: 2007 EH - JPL , 2007 EH - SSA
2007, Mar 13	Apollo NEA 2007 EK ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.69 LD. Minimum miss distance 0.69 LD. [2007-05] See: 2007 EK - JPL , 2007 EK - SSA
2007, Mar 25	Apollo NEA 2006 RH120 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.92 LD. [2007-06] See: 2006 RH120 - JPL , 2006 RH120 - SSA

	See also: http://www.space.com/14037-earth-2-moons-asteroids-theories.html http://en.wikipedia.org/wiki/2006_RH120 See also: 14 Jun 2007. Ref: - T. Kwiatkowski, A. Kryszczyńska, M. Polińska, et al., 2009, <i>Astronomy & Astrophysics</i>, 495, 967, "Photometry of 2006 RH120: an asteroid temporary captured into a geocentric orbit." See: http://adsabs.harvard.edu/abs/2009A%26A...495..967K
2007, Mar 31	Apollo NEA 374851 (2006 VV2), $H = 16.9$ mag, $D \approx 1800$ m, PHA) passed Earth at a nominal miss distance of 8.81 LD. Minimum miss distance 8.81 LD. See: 2006 VV2 - JPL , 374851 2006 VV2 Ref: - R. Huziak, 2007, <i>Journal of the Royal Astronomical Society of Canada</i>, 101, 165, "Ramblings of a variable-star addict: precise measurements for Earth-crossing asteroid 2006 VV2". See: http://adsabs.harvard.edu/abs/2007JRASC.101..165H See also: http://www.rasc.ca/news/2006VV2.shtml http://antwrp.gsfc.nasa.gov/apod/ap070405.html See also: 29 Mar 2177.
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2007, Apr 13	S.C. Lowry, A. Fitzsimmons, P. Pravec, et al., 2007, <i>Science</i>, 316, 272, "Direct detection of the asteroidal YORP effect." See: http://star.pst.qub.ac.uk/comast/papers/YORP1.pdf
2007, Apr 24	Apollo NEA 2007 HB15 ($H = 27.7$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.57 LD. [2007-07] See: 2007 HB15 - JPL , 2007 HB15 - SSA
2007, May	G.C. de Elía, A. Brunini, 2007, <i>Astronomy & Astrophysics</i>, 466, 1159, "Collisional and dynamical evolution of the main belt and NEA population." See: http://adsabs.harvard.edu/abs/2007A%26A...466.1159D
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	See: http://adsabs.harvard.edu/abs/2007Icar..188..266D
2007, May	R.A. Fevig, U. Fink, 2007, <i>Icarus</i> , 188, 175, "Spectral observations of 19 weathered and 23 fresh NEAs and their correlations with orbital parameters." See: http://adsabs.harvard.edu/abs/2007Icar..188..175F
2007, May	R.B. Firestone, A. West, Z. Revay, et al., 2007, in: <i>American Geophysical Union, Spring Meeting 2007</i> , abstract #PP41A-01, "Evidence for a massive extraterrestrial airburst over North America 12.9 ka ago." See: http://adsabs.harvard.edu/abs/2007AGUSMPP41A..01F
2007, May	R.B. Firestone, A. West, J.P. Kenneth, et al., 2007, in: <i>American Geophysical Union, Spring Meeting 2007</i> , abstract #PP43A-01, "Evidence for an extraterrestrial impact event 12,900 years ago that contributed to megafaunal extinctions and the Younger Dryas cooling." See: http://adsabs.harvard.edu/abs/2007AGUSMPP43A..01F
2007, May	M. Moidel, <i>Space Viz</i> , 2007, DVD, <i>Planetary Defense</i> . Interviews with M. A'Hearn, M. Belton, R. Binzel, C. Chapman, A.C. Clarke, F.J. Dyson, A.W. Harris (Germany), A.W. Harris (USA), D.H. Levy, S. Ostro, D. Scheeres, R. Schweickart, D. Steel, G. Stokes, R.J. Whiteley, S.P. Worden, and D.K. Yeomans. See: http://spaceviz.com/documentaries/planetarydefense/planetarydefense.html
2007, May 9-12	1st International Workshop on NEO Deflection Policy , International Space University, Strasbourg (France), organized by the Association of Space Explorers (ASE). See: http://www.space-explorers.org/committees/NEO/docs/ASE_NEO_Aug06.pdf http://www.space-explorers.org/committees/NEO/workshop1.html http://www.isunet.edu/index.php?option=com_docman&task=doc_view&gid=131&Itemid=26 http://www.spaceref.com/news/viewpr.html?pid=20596
2007, May 10	Puerto Lápice Fireball and Meteorite . A brilliant fireball of absolute magnitude – 14 ± 4 was widely seen all over Spain. The fireball travelled from south to north and experienced various explosions along its trajectory. The Spanish Fireball Network (SPMN) and numerous images taken by observers documented the fall. Some 500 g of meteorite material was collected at Puerto Lápice (Ciudad Real, Castilla-La Mancha, Spain), notably achondrite (eucrite, brecciated).

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2007, May 31	In 2006, 14 space agencies (ASI, Italy; CNES, France; CNSA China; CSA, Canada; CSIRO, Australia; DLR, Germany; ESA, Europe; ISRO, India; JAXA, Japan; KARI, Republic of Korea; NASA, USA; NSAU, Ukraine; Roscosmos, Russia; BNSC/UKSA, UK) began a series of discussions on global interests in space exploration. Together they took the step of elaborating a vision for peaceful robotic and human space exploration, focusing on destinations within the Solar System, and developed a common set of key space exploration themes. This vision was articulated in 'The Global Exploration Strategy: The Framework for Coordination,' hereinafter referred to as the 'Framework Document'. A key finding of the Framework Document is the need to establish a voluntary, non-binding international coordination mechanism through which individual agencies may exchange information regarding interests, objectives and plans in space exploration, with the goal of strengthening both individual exploration programs as well as the collective effort. The coordination mechanism is named the International Space Exploration Coordination Group (ISECG). See: http://www.globalspaceexploration.org/
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2007, Jun	J.K. Paty, W.U. Reimold, 2007, <i>Journal of Earth System Science</i>, 116, 81, "Impact cratering — fundamental process in geoscience and planetary science." See: http://adsabs.harvard.edu/abs/2007JESS..116..81P
2007, Jun	D.J. Scheeres, M. Abe, M. Yoshikawa, et al., 2007, <i>Icarus</i>, 188, 425, "The effect of YORP on Itokawa." See: http://adsabs.harvard.edu/abs/2007Icar..188..425S
2007, Jun	D.J. Scheeres, 2007, <i>Icarus</i>, 188, 430, "The dynamical evolution of uniformly rotating asteroids subject to YORP." See: http://adsabs.harvard.edu/abs/2007Icar..188..430S

2007, Jun 11-15	International meeting on minor bodies <i>Meteoroids 2007</i> , Barcelona (Spain), 11-15 June 2007. See: http://www.spmn.uji.es/meteoroids-2007/
2007, Jun 14	Apollo NEA 2006 RH120 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.72 LD. [2007-08] See: 2006 RH120 - JPL , 2006 RH120 - SSA See also: http://www.space.com/14037-earth-2-moons-asteroids-theories.html http://en.wikipedia.org/wiki/2006_RH120 See also: 25 Mar 2007 . Ref: - T. Kwiatkowski, A. Kryszczyńska, M. Polńska, et al., 2009, <i>Astronomy & Astrophysics</i> , 495, 967, "Photometry of 2006 RH120 : an asteroid temporary captured into a geocentric orbit." See: http://adsabs.harvard.edu/abs/2009A%26A...495..967K
2007, Jun 26-29	VIIth Workshop on Catastrophic Disruption in the Solar System , Alicante (Spain). See: http://irtfweb.ifa.hawaii.edu/~sjb/CD07/CD07.htm
2007, Jul 6	C.R. Chapman, 2007, <i>New Scientist</i> , Issue 2611, 6 July 2007, "How not to save the planet." See: http://www.newscientist.com/article/mg19526115.800-comment-how-not-to-save-the-planet.html
2007, Jul 20	"Potentially hazardous Near Earth Objects coming to your neighborhood soon". See: http://www.greatdreams.com/near.htm
2007, Jul 23	Green.view, 2007, <i>The Economist</i> , 23 July 2007, The threat from outer space." See: http://www.economist.com/node/9533468
2007, Jul 26	Apollo NEA 2020 HL6 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 1.14 LD. Minimum miss distance 0.50 LD. See: 2020 HL6 – S2P , 2020 HL6 - JPL
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2007, Aug 7	Earth-grazing fireball EN070807 passed through the upper Earth atmosphere with an orbit belonging to the rare Aten asteroid type. See: http://adsabs.harvard.edu/abs/2008LPICo1405.8217S http://www.lpi.usra.edu/meetings/acm2008/pdf/8217.pdf http://en.wikipedia.org/wiki/Earth-grazing_fireball http://en.wikipedia.org/wiki/The_Great_Daylight_1972_Fireball#All_known_Earth-grazing_fireballs
2007, Aug 13-17	70th Annual Meeting Meteoritical Society , Tucson (AZ, USA), 13-17 August 2007. See: http://www.lpi.usra.edu/meetings/metsoc2007/
2007, Aug 19-24	2nd European Planetary Science Congress (EPSC 2007) , Potsdam (Germany). See: http://meetings.copernicus.org/epsc2007/
2007, Sep	M. Delbò, A. Dell'Oro, A.W. Harris, et al., 2007, <i>Icarus</i> , 190, 236, "Thermal inertia of near-Earth asteroids and implications for the magnitude of the Yarkovsky effect." See: http://adsabs.harvard.edu/abs/2007Icar..190..236D
2007, Sep	W.U. Reimold, 2007, <i>Meteoritics & Planetary Science</i> , 42, 1467, "The impact crater bandwagon. (Some problems with the terrestrial impact cratering record)" See: http://adsabs.harvard.edu/abs/2007M%26PS...42.1467R
2007, Sep 5	Apollo NEA 2007 RS1 ($H = 31.1$ mag, $D \approx 2.1$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2007-09] See: 2007 RS1 - JPL , 2007 RS1 - SSA See also: 2 Sep 1964 .
2007, Sep 6	W.F. Bottke, D. Vokrouhlický, D. Nesvorný, et al., 2007, <i>Nature</i> , 449, 48, "An asteroid breakup 160 Myr ago as the probable source of the K/T impactor." See: http://adsabs.harvard.edu/abs/2007Natur.449...48B See also:

	http://www.planetary.org/news/2007/0921_Ancient_Collision_between_Asteroids.html
2007, Sep 6	P. Claeys, S. Goderis, 6 September 2007, <i>Nature</i> , 449, 30, "Lethal billiards." See: http://adsabs.harvard.edu/abs/2007Natur.449...30C
2007, Sep 12-15	2nd International Workshop on NEO Deflection Policy , Sibiu (Romania), organized by the Association of Space Explorers (ASE). See: http://www.oosa.unvienna.org/pdf/pres/stsc2008/tech-12.pdf
2007, Sep 15	Carancas Chondritic Fireball and Meteorite Fall on the Altiplano at the Peru-Bolivia border, near the village of Carancas (Peru), forming a 13.5-m wide crater, with a depth of 4.5 m. The stony meteorite may have had original mass of 1-2 ton. Ref: - J. Borovička, P. Spurný, 2008, <i>Astronomy & Astrophysics</i> , 485, 1, "The Carancas meteorite impact – encounter with a monolithic meteoroid." See: http://adsabs.harvard.edu/abs/2008A%26A...485L...1B - P. Brown, D.O. ReVelle, E.A. Silber, et al., September 2008, <i>Journal of Geophysical Research</i> , 113, 9007, "Analysis of a crater-forming meteorite impact in Peru ." See: http://adsabs.harvard.edu/abs/2008JGRE..113.9007B - G. Tancredi, J. Ishitsuka, P. Schultz, et al., 2009, <i>Meteoritics & Planetary Science</i> , 44, 1967, "A meteorite crater on Earth formed on September 15, 2007: the Carancas hypervelocity impact." See: http://adsabs.harvard.edu/abs/2009M%26PS...44.1967T See also: http://news.nationalgeographic.com/news/2007/09/070921-meteor-peru.html http://www.lifescittlemysteries.com/1535-when-space-attacks-6-craziest-meteor-impacts-history.html http://en.wikipedia.org/wiki/Carancas_impact_event
2007, Sep 27	NASA spacecraft Dawn launched. Asteroid 4 Vesta ($H = 3.20$ mag, $D = 530$ km, Main-belt asteroid) rendezvous in July 2011, leaving May 2012. Dwarf planet 1 Ceres ($H = 3.34$ mag, $D = 952$ km) rendezvous March 6, 2015. End of primary mission July 2015. See: http://dawn.jpl.nasa.gov/ http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2014-313 http://www.jpl.nasa.gov/news/news.php?release=2014-443
2007, Sep 28	Northern Ostrobothnia Fireball and Airburst (Finland). See:

	http://yle.fi/uutiset/super-meteor_lights_up_northern_sky/5803349 http://en.wikipedia.org/wiki/List_of_meteor_air_bursts
2007, Oct	A.W. Harris, 2007, <i>American Astronomical Society DPS meeting</i> #39, #50.01, <i>Bulletin of the American Astronomical Society</i> , 39, 511, "An update of the population of NEAs and impact risk." See: http://adsabs.harvard.edu/abs/2007DPS....39.5001H
2007, Oct 8	IAU General Secretary Karel A. van der Hucht informs the director of the Harvard-Smithsonian Center for Astrophysics, host of the Minor Planet Center , of the full support of the IAU Executive Committee for the MPC and its new director, Timothy B. Spahr. The IAU GS expresses its gratitude to MPC director-emeritus Brian G. Marsden for directing the MPC during more than three decades in an outstanding way.
2007, Oct 9	Tom Gehrels, founder of the Spacewatch project, named winner of the 2007 Harold Masursky Award by the the American Astronomical Society Division of Planetary Sciences at the DPS 39th annual meeting in Orlando (FL, USA). See: http://uanews.org/node/16265
2007, Oct 9	R.B. Firestone, A. West, J.P. Kennett, et al., 2007, <i>Proc. National Academy of Sciences</i> , 104, 16016, "Evidence for an extraterrestrial impact 12,900 years ago that contributed to the megafaunal extinctions and the Younger Dryas cooling." See: https://www.pnas.org/content/104/41/16016 See also: D.J. Kennett, J.P. Kennett, A. West, et al., 2009, <i>Science</i> , 323, 94, "Nanodiamonds in the Younger Dryas boundary sediment layer." See: http://adsabs.harvard.edu/abs/2009Sci...323...94K But see also: http://adsabs.harvard.edu/abs/2010DDA....41.0601H
2007, Oct 11	Testimony of Russell L. Schweickart, chairman, B612 Foundation , before the Space and Aeronautics Subcommittee of the U.S. House Committee on Science and Technology.
2007, Oct 12	Apollo NEA 2007 TX22 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.37 LD. [2007-10] See: 2007 TX22 - JPL , 2007 TX22 - SSA
2007, Oct 17, 14:52	Apollo NEA 2007 UO6 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.93 LD. [2007-11] See: 2007 UO6 - JPL , 2007 UO6 - SSA

2007, Oct 17, 15:25	Apollo NEA 2007 UN12 ($H = 28.7$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.18 LD. Minimum miss distance 0.18 LD. [2007-12] See: 2007 UN12 - JPL , 2007 UN12 - SSA
2007, Oct 18	Apollo NEA 2007 UD6 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.50 LD. [2007-13] See: 2007 UD6 - JPL , 2007 UD6 - SSA See also: 18 Oct 2048 .
2007, Oct 19	ESA announced the results of its <i>Cosmic Visions 2015 – 2025</i> call for proposals: seven space science missions selected for further study, including Marco Polo , a NEO rendez-vous and sample-return mission. See: http://www.esa.int/esaSC/SEM11QAMS7F_index_0.html
2007, Oct 20-21	NASA Workshop on Low-Cost Missions to NEOs . NASA Ames Research Center, Mountain View (CA, USA).
2007, Oct 30	Apollo NEA 2007 US51 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.58 LD. [2007-14] See: 2007 US51 - JPL , 2007 US51 - SSA
2007, Nov	A.A. Christou, J. Oberst, D. Koschny, et al., 2007, <i>Planetary and Space Science</i> , 55, 2049, "Comparative studies of meteoroid-planet interaction in the inner solar system." See: http://adsabs.harvard.edu/abs/2007P%26SS...55.2049C
2007, Nov 5	R.R. Landis, D.J. Korsmeyer, P.A. Abell, et al., 2007, in: Proc. <i>First International Conference on the Exploration of Phobos and Deimos</i> , 5-8 November 2007, Moffett Field (CA, USA). LPI Contribution No. 1377, p.24, "Prelude to human exploration of Phobos and Deimos: the NEO factor." See: http://adsabs.harvard.edu/abs/2007epd..conf...24L
2007, Nov 6	Apollo NEA 2007 VK184 ($H = 22.2$ mag, $D \approx 130$ m) passed Earth at a nominal miss distance of 23.9 LD. Minimum miss distance 23.9 LD. See: 2007 VK184 - JPL , 2007 VK184 - SSA See also: http://neo.jpl.nasa.gov/news/news183.html https://en.wikipedia.org/wiki/2007_VK184 See also: 2 Jun 2048, 6 Jun 2118 .

2007, Nov 8	<i>Congressional hearings on Near-Earth Objects (NEOs) – Status of the Survey Program and Review of NASA's Report to Congress</i>, for the US House of representatives, Committee on Science and Technology, Subcommittee on Space and Aeronautics. Speakers included chairman Mark Udall, Rep. Luis G. Fortuno, Donald Campbell (Cornell University), Jim Green (NASA Hq), Scott Pace (NASA Hq), Russell L. Schweickart (B612 Foundation), Anthony Tyson (University of California at Davis), and Donald Yeomans (JPL). See: http://democrats.science.house.gov/media/File/Commdocs/hearings/2007/space/08nov/Tyson_testimony.pdf http://www.plutotoday.com/news/viewstr.html?pid=25962 http://www.b612foundation.org/press/press.html #17, http://www.b612foundation.org/papers/Hearing_Charter.pdf
2007, Nov 14	Apollo NEA 2007 VF189 ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.61 LD. Minimum miss distance 0.61 LD. [2007-15] See: 2007 VF189 - JPL , 2007 VF189 - SSA See also: 14 Nov 1944.
2007, Dec	D.P. Rubincam, 2007, <i>Icarus</i>, 192, 460, "Orbital YORP and asteroid orbit evolution, with application to Apophis." See: http://adsabs.harvard.edu/abs/2007Icar..192..460R
2007, Dec	Wording inserted into the Departments of Commerce, Justice, Science, and Related Agencies Appropriations Act, 2008 (H.R. 3093): NASA is directed to provide additional funding for the Arecibo Observatory; NASA shall contract with the National Research Council (NRC) to study the Arecibo issue and make recommendations; As part of its deliberations, the NRC shall review NASA's report 2006 <i>Near-Earth Object Survey and Deflection Study</i> as well as any other relevant literature; An interim report with recommendations focusing primarily on the optimum approach to the survey program shall be submitted within 15 months of enactment of this Act; The NRC study shall include an assessment of the costs of various alternatives, including options that may blend the use of different facilities (whether ground- or space-based), or involve international cooperation. See: http://www7.nationalacademies.org/ocga/laws/PL110-161.asp
2007, Dec 3	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) Action Team 14, <i>Interim Report (2007 – 2008)</i>. See: http://www.unoosa.org/pdf/limited/c1/AC105_C1_L295E.pdf
2007, Dec 4	UN - Committee on the Peaceful Uses of Outer Space (UN-

	COPUOS). Information on research in the field of NEOs carried out by Member States, international organizations and other entities. See: http://www.unoosa.org/pdf/reports/ac105/AC105_896E.pdf
2007, Dec 13	Apollo NEA 2007 XB23 ($H = 27.1$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.26 LD. Minimum miss distance 0.25 LD. [2007-16] See: 2007 XB23 - JPL , 2007 XB23 - SSA See also: 11 Dec 2024.
2007, Dec 15	Apollo NEA 2007 YN1 ($H = 25.0$ mag, $D \approx 42$ m) passed Earth at a nominal miss distance of 1.02 LD. Minimum miss distance 1.02 LD. See: 2007 YN1 - JPL , 2007 YN1 - SSA
2007, Dec 27	Apollo NEA 2007 YP56 ($H = 25.8$ mag, $D \approx 24$ m) passed Earth at a nominal miss distance of 0.54 LD. Minimum miss distance 0.54 LD. [2007-17] See: 2007 YP56 - JPL , 2007 YP56 - SSA
2008, Jan 1	5061 NEAs known, of which 910 PHAs. See: http://neo.jpl.nasa.gov/stats/
2008	The International Astronautical Federation creates an IAF Technical Committee on NEOs. See: http://www.iafastro.net/?id=993 http://www.unoosa.org/pdf/pres.stsc2009/tech-31.pdf
2008	The Space Generation Advisory Council (SGAC) documentary about issues surrounding defending the Earth from asteroid and comet impacts, "Near Earth Objects and Planetary Defence." See: http://spacegeneration.org/index.php/activities/papers-a-reports/124-neodocumentary
2008	Asteroid Finder, a space project of the German Aerospace Center (DLR) approved, planned for launch in 2013 with an one-year baseline mission duration, with a 25-cm telescope mirror and a $2^\circ \times 2^\circ$ FoV camera, to operate in a Sun-synchronous low-Earth orbit. The primary goals are to detect and track the population of NEOs interior to Earth's orbit, and to determine their size distribution and orbital properties, along with impact hazard assessment. Ref: - M. Drentschew, G.J. Hahn, E. Kührt, et al., 2008, Proc. <i>Asteroids, Comets, Meteors 2008</i>, 14-18 July 2008, Baltimore (MD, USA), LPI Contribution No. 1405, paper id. 8125, "Modeling of the expected performance for the German AsteroidFinder." See: http://adsabs.harvard.edu/abs/2008LPICo1405.8125D

	- S. Mottola, A. Börner, J.T. Grundmann, G.J. Hahn, et al., 2008, <i>Proc. Asteroids, Comets, Meteors 2008</i>, 14-18 July 2008, Baltimore (MD, USA), LPI Contribution No. 1405, paper id. 8140, "AsteroidFinder: a space-based search for IEOs." See: http://adsabs.harvard.edu/abs/2008LPICo1405.8140M See also: http://www.dlr.de/pf/Portaldata/6/Resources/asteroiden_und_kometen/DLR_AK_Report_2008.pdf http://www.dlr.de/pf/en/desktopdefault.aspx/tabid-174/319_read-18911/ http://www.oosa.unvienna.org/pdf/pres/stsc2008/tech-13.pdf http://www.lpi.usra.edu/meetings/acm2008/pdf/8140.pdf http://www.spiegel.de/international/germany/0,1518,684375,00.html http://planetarydefense.blogspot.com/2010/03/dlr-asteroidfinder-project.html
2008	R.P. Binzel, C.A. Thomas, A. Tokunaga, 2008, in: <i>Proc. Asteroids, Comets, Meteors 2008</i>, 14-18 July 2008, Baltimore (MD, USA), LPI Contribution No. 1405, paper id. 8228, "Spectral properties of Near-Earth Object mission targets." See: http://adsabs.harvard.edu/abs/2008LPICo1405.8228B
2008	R.-M. Bonnet, L. Woltjer, 2008, <i>Surviving 1000 Centuries</i> (Berlin: Springer Praxis Books), p. 62, chapter 3.3, "Solar System hazards." See: http://adsabs.harvard.edu/abs/2008stc..book.....B
2008	P.C. Plait, <i>Death from the skies: these are the ways the world will end</i> (Penguin Books: London). See: http://en.wikipedia.org/wiki/Death_from_the_Skies#Reviews See also: http://www.wired.com/geekdad/2008/11/death-from-the/ http://skeptichick.org/2008/10/book-review-death-from-the-skies-by-phil-plait/
2008	P. Spurný, J. Borovicka, Z. Ceplecha, L. Shrbený, 2008, in: <i>Proc. Asteroids, Comets, Meteors 2008</i>, 14-18 July 2008, Baltimore (MD, USA), LPI Contribution No. 1405, paper id. 8217, "Precise multi-instrument data on 45 fireballs recorded over central Europe in the period 2006-2008." See: http://adsabs.harvard.edu/abs/2008LPICo1405.8217S
2008, Jan	J.D. Giorgini, L. Benner, S.J. Ostro, et al., 2008, <i>Icarus</i>, 193, 1, "Predicting the Earth encounters of (99942) Apophis." See: http://adsabs.harvard.edu/abs/2008Icar..193....1G http://neo.jpl.nasa.gov/apophis/
2008 Jan	N. Pinter, S.E. Ishman, 2008, <i>GSA Today</i>, 18 (1), 38, "Impacts, mega-tsunami and other extraordinary claims."

	See: http://www.geosociety.org/gsatoday/archive/18/1/pdf/i1052-5173-18-1-37.pdf
2008, Jan	B. Schmitz, D.A.T. Harper, B. Peucker-Ehrenbrink, et al., 2008, <i>Nature Geoscience</i> , 1, 49, "Asteroid breakup linked to the Great Ordovician Bio-diversification Event." See: http://www.nature.com/ngeo/journal/v1/n1/full/ngeo.2007.37.html
2008, Jan 1	H.-K. Moon, Y.-I., Byon, S.N. Raymaond, T. Spahr, 2008, <i>Icarus</i> , 19, 53, "Realistic survey simulations for kilometer class near Earth objects." See: http://adsabs.harvard.edu/abs/2008Icar..193...53M
2008, Jan 13	Apollo NEA 2008 AF3 ($H = 26.4$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 0.98 LD. Minimum miss distance 0.98 LD. [2008-01] See: 2008 AF3 - JPL , 2008 AF3 - SSA
2008, Jan 14	First meeting International Primitive Body Exploration Working Group (IPEWG) , Okinawa (Japan). JAXA will maintain website. See: http://www.lpi.usra.edu/sbag/meetings/jan2009/presentations/Sykes_ipewg_SBAG.pdf
2008, Jan 16	Apollo NEA 2008 BW2 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.93 LD. Minimum miss distance 0.92 LD. [2008-02] See: 2008 BW2 - JPL , 2008 BW2 - SSA
2008, Jan 29	Apollo NEA 2007 TU24 ($H = 20.5$ mag, $D = 250$ m, PHA) passed Earth at a nominal miss distance of 1.44 LD. Minimum miss distance 1.44 LD. See: 2007 TU24 - JPL , 2007 TU24 - SSA Closest approach by a known asteroid of this size or larger until 2027 . Radar detection was acquired on 23 January using the NASA Goldstone 70 m antenna, part of NASA's Deep Space network station in the Southern California Mojave Desert. See: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=1586 http://antwarp.gsfc.nasa.gov/apod/ap080130.html See also: http://en.wikipedia.org/wiki/2007_TU24 See also: 30 Jan 2168 .
2008, Jan 30	Apollo NEA 2007 WD5 ($H = 24.5$ mag, $D \approx 50$ m, discovered by the Catalina Sky Survey) passed Mars by 26,100 km. See: 2007 WD5 - JPL , 2007 WD5 - SSA

	See also: http://neo.jpl.nasa.gov/news/news151.html http://uanews.org/node/17415 http://www.jpl.nasa.gov/news/news.cfm?release=2007-152 http://neo.jpl.nasa.gov/news/news153.html http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2007%20WD5;orb=1;cov=0;log=0;cad=1#cad http://en.wikipedia.org/wiki/2007_WD5
2008, Jan 31	Apollo NEA 2008 BC15 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.77 LD. Minimum miss distance 0.77 LD. [2008-03] See: 2008 BC15 - JPL , 2008 BC15 - SSA
2008, Feb	R.W. Sinnott, 2008, <i>Sky & Telescope</i>, 115, no.2, p. 86, "Wouldn't a 300-meter asteroid be able to eclipse the Moon, if it should pass in front of it?" See: http://adsabs.harvard.edu/abs/2008S%26T...115R..86S
2008, Feb 5	Aten NEA 2008 CT1 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.35 LD. Minimum miss distance 0.34 LD. [2008-04] See: 2008 CT1 - JPL , 2008 CT1 - SSA
2008, Feb 6	Apollo NEA 2008 CE22 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 1.001 LD. Minimum miss distance 0.999 LD. See: 2008 CE22 - JPL , 2008 CE22 - SSA See also: 5 Feb 2066.
2008, Feb 15	Apollo NEA 2008 CK70 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 0.97 LD. Minimum miss distance 0.97 LD. [2008-05] See: 2008 CK70 - JPL , 2008 CK70 - SSA See also: https://en.wikipedia.org/wiki/2008_CK70
2008, Feb 18	T. Graham, R.L. Schweickart, 2008, <i>Scientific American</i>, 18 February 2008, "NASA's flimsy argument for nuclear weapons." See: http://www.scientificamerican.com/article.cfm?id=nasas-flimsy-argument-for-nuclear-weapons
2008, Feb 18-19	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Scientific and technical Subcommittee, 45th Session, Action Team 14 on NEOs meets in Vienna (Austria). Report (11 March 2008): http://www.unoosa.org/pdf/reports/ac105/AC105_911E.pdf

2008, Feb 26	The Planetary Society Apophis Mission Design Competition results released. See: http://planetary.org/programs/projects/near_earth_objects/apophis_competition/rules.html http://www.planetary.org/programs/projects/apophis_competition/update_20080226.html http://www.esa.int/SPECIALS/NEO/SEMJCNM5NDF_0.html
2008, Mar	Small Bodies Assessment Group, chartered by NASA's Planetary Science Division to identify scientific priorities and opportunities for the exploration of asteroids, comets, interplanetary dust, small satellites, and Trans-Neptunian Objects. The group also provides scientific input on the utility of asteroids and comets in support of human space activities. See: http://www.lpi.usra.edu/sbag/
2008, Mar	R. Linfield, J. Vancleve, H.J. Reitsema, R. Arentz, 2008, in: Proc. 39th Lunar and Planetary Science Conference, League City (TX, USA), 10-14 March 2008, <i>Lunar and Planetary Science XXXIX</i>, LPI Contribution No. 1391, p. 1412, "Searching for Near Earth Objects from a Venus-like orbit." See: http://adsabs.harvard.edu/abs/2008LPI....39.1412L Read also: - R. Linfield, J. Vancleve, H.J. Reitsema, R. Arentz, 2008, in: Proc. <i>Asteroids, Comets, Meteors 2008</i>, 14-18 July 2008, Baltimore (MD, USA). LPI Contribution No. 1405, paper id. 8270, "Searching for Near Earth Objects: an IR telescope in a Venus-like orbit." - See: http://adsabs.harvard.edu/abs/2008LPICo1405.8270L - B. Corbin, 2010, presented at the 61st International Astronautical Congress, Prague (Czech Republic), 27 September - 1 October 2010, "Implementing advanced technologies and models to reduce uncertainty in a global, cost-effective asteroid mitigation system." - See: http://spacegeneration.org/index.php/activities/current-projects/neo-working-group/move-an-asteroid http://www.spacegeneration.org/index.php/eventstopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf
2008, Mar 3	Apollo NEA 2008 EK68 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 1.51 LD. Minimum miss distance 0 LD. See: 2008 EK68 - JPL , 2008 EK68 - SSA
2008, Mar 7	R. Stone, 2008, <i>Science</i>, 319, 1326, "Preparing for doomsday." See: http://www.sciencemag.org/content/319/5868/1326.summary/

2008, Mar 7	R. Stone, 2008, <i>Science</i> , 319, 1329, "The state of our planet's defenses." See: http://www.sciencemag.org/content/319/5868/1329.summary
2008, Mar 9	Apollo NEA 2008 EZ7 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2008-06] See: 2008 EZ7 - JPL , 2008 EZ7 - SSA
2008, Mar 10, 05:2	Apollo NEA 2008 EF32 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.17 LD. Minimum miss distance 0.13 LD. [2008-07] See: 2008 EF32 - JPL , 2008 EF32 - SSA
2008, Mar 10, 19:3	Apollo NEA 2008 EM68 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.15 LD. [2008-08] See: 2008 EM68 - JPL , 2008 EM68 - SSA
2008, Mar 23	Apollo NEA 2008 FK ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2008-09] See: 2008 FK - JPL , 2008 FK - SSA
2008, Mar 29	Apollo NEA 2008 FP ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [2008-10] See: 2008 FP - JPL , 2008 FP - SSA
2008, Apr	A. Carusi, G. D'Abramo, G.B. Valsecchi, 2008, <i>Icarus</i> , 194, 450, "Orbital and mission planning constraints for the deflection of NEOs impacting on Earth." See: http://adsabs.harvard.edu/abs/2008Icar..194..450C
2008, Apr	G.S. Collins, N. Artemieva, K. Wünnemann, et al., 2008, <i>Terra Nova</i> , 20, 165, "Evidence that Lake Cheko is not an impact crater." See: http://onlinelibrary.wiley.com/doi/10.1111/j.1365-3121.2008.00791.x/full .
2008, Apr	J. Davis, 2008, <i>Astronomy</i> , 36, No. 4, p. 34, "185 million years before the dinosaurs' demise, did an asteroid nearly end life on Earth?" See: http://adsabs.harvard.edu/abs/2008Ast....36d..34D
2008, Apr	M.A. McDonald, H.J. Melosh, S.P.S. Gulick, 2008, <i>Geophysical Research Letters</i> , 35(7), L07203, "Oblique impacts and peak ring

	position: Venus and Chicxulub ." See: http://adsabs.harvard.edu/abs/2008GeoRL...3507203M
2008, Apr 3	Apollo NEA 2008 GM2 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.54 LD. Minimum miss distance 0.54 LD. [2008-11] See: 2008 GM2 - JPL , 2008 GM2 - SSA See also: 4 Apr 1947 .
2008, Apr 7	Apollo NEA 2008 GF1 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.76 LD. Minimum miss distance 0.76 LD. [2008-12] See: 2008 GF1 - JPL , 2008 GF1 - SSA See also: 7 Apr 2004 .
2008, Apr 7	Fall of the Berduc L6 Chondrite Meteorite . A daylight fireball was witnessed by hundreds of people from Argentina and Uruguay, and recorded by an infrasound array in Paraguay. Ref: - J.M. Trigo-Rodriguez, J. Llorca, J.M. Madiedo, et al., 2010, <i>Meteoritics and Planetary Science</i> , 45, 383, "The Berduc L6 chondrite fall : meteorite characterization, trajectory, and orbital elements." See: http://adsabs.harvard.edu/abs/2010M%26PS...45..383T
2008, Apr 9	Apollo NEA 2018 GY3 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 1.57 LD. Minimum miss distance 1.57 LD. It passed the Moon at a nominal miss distance of 0.80 LD. Minimum miss distance 0.80 LD. See: 2018 GY3 - JPL , 2018 GY3 - SSA
2008, Apr 23-26	3rd International Workshop on NEO Deflection Policy , Guácimo (Costa Rica), organized by the Association of Space Explorers (ASE). See: http://www.space-explorers.org/committees/NEO/workshop3.html http://www.oosa.unvienna.org/pdf/pres/stsc2008/tech-12.pdf
2008, May 10	Apollo NEA 2008 JL24 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [2008-13] See: 2008 JL24 - JPL , 2008 JL24 - SSA
2008, May 19	Apollo NEA 2015 XR169 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 7.17 LD. Minimum miss distance 0.13 LD. See: 2015 XR169 - JPL , 2015 XR169 - SSA

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	http://www.space-explorers.org/committees/NEO/docs/COSPAR-paper.pdf
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2008, Jul 23	Tajikistan superbolide . See: http://www.bolides09.com/docs/bolides09_program.pdf See also: http://adsabs.harvard.edu/doi/10.1111/maps.12217
2008, Jul 29	Apollo NEA 2008 OT7 ($H = 27.1$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [2008-14] See: 2008 OT7 - JPL , 2008 OT7 - SSA
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2008, Sep 5	ESA spacecraft Rosetta flew at 803 km by Main-belt asteroid 2867 Šteins (1969 VC, $H = 12.7$ mag, $D = 6.7 \times 5.8 \times 4.5$ km). See: 1969 VC - JPL , 2867 Steins - SSA Ref: - K.-H. Glassmeier, H. Boehnhardt, D. Koschny, et al., 2007, <i>Space Science Reviews</i> , 128, 1, "The Rosetta mission: flying towards the origin of the Solar System." See: http://adsabs.harvard.edu/abs/2007SSRv..128....1G - P.R. Weissman, M.D. Hicks, P.A. Abell, et al., 2008, <i>Meteoritics & Planetary Science</i> , 43, 905, " Rosetta target asteroid 2867 Šteins : an unusual E-type asteroid." See: http://adsabs.harvard.edu/abs/2008M%26PS...43..905W - H.U. Keller, C. Barbieri, D. Koschny, et al., 2010, <i>Science</i> , 327, 190, "E-type asteroid (2867) Šteins as imaged by OSIRIS on board Rosetta ". See: http://adsabs.harvard.edu/abs/2010Sci...327..190K - S. Besse, P. Lamy, L. Jorda, et al., November 2012, <i>Icarus</i> , 221, 1119, "Identification and physical properties of craters on asteroid (2867) Steins ." See: http://adsabs.harvard.edu/abs/2012Icar..221.1119B - L. Jorda, P.L. Lamy, R.W. Gaskell, et al., November 2012, <i>Icarus</i> , 221, 1089, "Asteroid (2867) Steins : shape, topography and global physical properties from OSIRIS observations." See: http://adsabs.harvard.edu/abs/2012Icar..221.1089J - S. Spjuth, L. Jorda, P.L. Lamy, et al., November 2012, <i>Icarus</i> , 221, 1101, "Disk-resolved photometry of asteroid (2867) Steins ." See: http://adsabs.harvard.edu/abs/2012Icar..221.1101S See also: http://www.scientificamerican.com/article.cfm?id=rosetta-starts-tracking-a http://esamultimedia.esa.int/docs/rosetta/Rosetta_fact_sheetv3.pdf http://www.esa.int/esaCP/SEM3LY2PGQD_index_0.html

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2008, Sep 21-26	<i>European Planetary Science Congress 2008 (EPSC 2008)</i> , Münster (Germany), 21-26 September 2008. See: http://meetings.copernicus.org/epsc2008/
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2008, Sep 22-25	<i>4th International Workshop on NEO Deflection Policy</i> , San Francisco (CA, USA), organized by the Association of Space Explorers (ASE). See: http://www.oosa.unvienna.org/pdf/pres/stsc2008/tech-12.pdf
2008, Sep 25	<i>The Association of Space Explorers (ASE) Committee on Near-Earth Objects Panel on Asteroid Threat Mitigation (PATM)</i> (chairman Russell Schweickart) presented its report <i>Asteroid Threats: a Call for Global Response</i> , to UN-COPUOS, Vienna (Austria). See: http://www.space-explorers.org/committees/NEO/docs/ATACGR.pdf http://www.unoosa.org/pdf/pres/stsc2009/tech-31.pdf
2008, Sep 29	R.L. Schweickart, 2008, presentation to the International Astronautical Congress, Glasgow (Scotland, UK), 29 September - 3 October 2008, "Decision program on asteroid threat mitigation." See: http://www.space-explorers.org/committees/NEO/docs/IAC08_paper.pdf
2008, Sep 30	Black Mesa Bolide , seen over the Oklahoma panhandle's Black Mesa State Park in the Midwestern US. See: http://farlimas.com/skyeye/skydatatext/space349text.html http://antwrp.gsfc.nasa.gov/apod/ap081011.html

2008, Oct	Lowell Observatory Near-Earth Object Search (LONEOS) discontinued the search for NEOs in favor of an asteroid photometric survey.
2008, Oct 3	Apollo NEA 2008 TN9 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.64 LD. Minimum miss distance 0.63 LD. [2008-15] See: 2008 TN9 - JPL , 2008 TN9 - SSA
2008, Oct 6	Impact. Apollo NEA 2008 TC3 ($H = 30.3$ mag, $D \approx 4.1$ m) was discovered by the Catalina Sky Survey (CSS) Mt Lemmon Survey 1.5 telescope, 19 hr before disintegrating over the Nubian desert (northern Sudan), in a Fireball and Airburst . Before impact, the international observer community responded with 570 observations from 27 observers. A systematic search in the desert located 280 fragments with a total mass of 3.9 kg. See: 2008 TC3 - JPL , 2008 TC3 - SSA Ref: - P. Jenniskens, M.H. Shaddad, D. Numan, et al., 2009, <i>Nature</i> , 458, 485, "The impact and recovery of asteroid 2008 TC3 ". See: http://adsabs.harvard.edu/abs/2009Natur.458..485J - Special Issue of <i>Meteoritics & Planetary Science</i> , 2010, 45, Issue 10-11, pp. 1553-1845, " 2008 TC3 and Almahata Sitta." Dedicated to NEA 2008 TC3 , impact on 6 October 2008. Editorial: P. Jenniskens, M.H. Shaddad, 2010, <i>Meteoritics & Planetary Science</i> , 45, 1553, " 2008 TC3 : the small asteroid with an impact." See: http://adsabs.harvard.edu/abs/2010M%26PS...45.1553J - P. Jenniskens, J. Vaubaillon, R.P. Binzel, et al., 2010, <i>Meteoritics & Planetary Science</i> , 45, 1590, " Almahata Sitta (= asteroid 2008 TC3) and the search for the ureilite parent body." See: http://adsabs.harvard.edu/abs/2010M%26PS...45.1590J - P. Scheirich, J. Durech, P. Pravec, 2010, <i>Meteoritics & Planetary Science</i> , 45, 1804, "The shape and rotation of asteroid 2008 TC3 ." See: http://adsabs.harvard.edu/abs/2009Natur.458..485J - P. Jenniskens, M.H. Shaddad, & the Almahata Sitta Consortium, 2010, in: J.A. Fernández, et al. (eds.), <i>Icy Bodies of the Solar System</i> , Proc. IAU Symp. No. 263, Rio de Janeiro (Brazil) 3-7 August 2010 (Cambridge: CUP), p. 227, "The unusually frail asteroid 2008 TC3 ." See: http://adsabs.harvard.edu/abs/2010IAUS..263..227J - E.Y. Aleshkina, V.V. Kupriyanov, A.V. Devyatkin, et al, 2011, <i>Solar System Research</i> , 45, 34, "Astrometric and photometric studies of the asteroid 2008 TC3 ." See: http://adsabs.harvard.edu/abs/2011SoSyR..45...34A - M.J. Kozubal, F.W. Forrest, R.F. Dantowitz, et al., 2011, <i>Meteoritics & Planetary Science</i> , 46, 534, "Photometric observations of Earth-impacting asteroid 2008 TC3 ." See: http://adsabs.harvard.edu/abs/2011M%26PS...46..534K

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2008, Oct 9	Apollo NEA 2008 TS26 ($H = 33.2$ mag, $D \approx 0.8$ m) passed Earth at a nominal miss distance of 0.033 LD (= 1.98 R_{Earth} from the geocenter). Minimum miss distance 0.030 LD. [2008-16] See: 2008 TS26 - JPL , 2008 TS26 - SSA See also: http://www.newscientist.com/blogs/shortsharpscience/2008/10/trio-of-asteroids-buzz-earth.html See also: http://neo.ssa.esa.int/newsletters [June 2020]
2008, Oct 16	US President Bush signs NASA Authorization bill (H.R. 6063), which among other topics requests information on: (1) a low-cost space mission with the purpose of rendezvous-ing with, attaching a

	tracking device, and characterizing the Apophis asteroid; and (2) a medium-sized space mission with the purpose of detecting NEOs with $D > 140$ m. Congress also requests that within two years after the date of enactment of this Act, the Director of the OSTP shall (1) develop a policy for notifying Federal agencies and relevant emergency response institutions of an impending NEO threat, if near-term public safety is at risk; and (2) recommend a federal agency or agencies to be responsible for: (a) protecting the United States from a NEO that is expected to collide with Earth; and (b) implementing a deflection campaign, in consultation with international bodies, should one be necessary. See: http://legislative.nasa.gov/PL%20110-422.pdf
2008, Oct 18	Apollo NEA 2008 UA202 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.87 LD. Minimum miss distance 0.86 LD. [2008-17] See: 2008 UA202 - JPL , 2008 UA202 - SSA See also: 21 Oct 2029.
2008, Oct 20	Apollo NEA 2008 US ($H = 31.4$ mag, $D \approx 1.9$ m) passed Earth at a nominal miss distance of 0.086 LD (= 5.16 R_{Earth} from the geocenter). Minimum miss distance 0.079 LD. [2008-18] See: 2008 US - JPL , 2008 US - SSA
2008, Oct 21	Apollo NEA 2019 UE4 ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 2.00. Minimum miss distance 0.34 LD. See: 2019 UE4 – SSA , 2019 UE4 – JPL See also: 10 Oct 2064.
2008, Oct 22	Apollo NEA 2008 UM1 ($H = 31.7$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.22 LD. Minimum miss distance 0.09 LD. [2008-19] See: 2008 UM1 - JPL , 2008 UM1 - SSA
2008, Oct 29	Apollo NEA 2008 VL ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 2.52 LD. Minimum miss distance 0.73 LD. See: 2008 VL - JPL , 2008 VL - SSA
2008, Nov	<i>Beyond the Moon. A New Roadmap for Human Space Exploration in the 21st Century</i>. Study report of The Planetary Society, advocating <i>inter alia</i> the exploration of Near Earth Asteroids by human spaceflight. See: http://www.planetary.org/special/roadmap/beyond_the_moon.pdf
2008, Nov	M. Delbò, P. Tanga, F. Mignard, 2008, <i>Planetary and Space Science</i>, 56, 1823, "On the detection of the Yarkovsky effect on near-Earth

	asteroids by means of Gaia ." See: http://adsabs.harvard.edu/abs/2008P%26SS...56.1823D
2008, Nov	O. Vaduvescu, M. Birlan, F. Colas, et al., 2008, <i>Planetary and Space Science</i> , 56, 1913, " EURONEAR : first results." See: http://adsabs.harvard.edu/abs/2008P%26SS...56.1913V
2008, Nov	ESA Space Situational Awareness (SSA) Preparatory Programme , a new ESA initiative, accepted at the November 2008 Ministerial Conference in Den Haag (Netherlands) as a new optional programme of ESA, covering the time frame 2009 – 2011. SSA includes activities in three main domains: space surveillance, space weather, and Near Earth Objects (NEOs). As part of the SSA programme, the 1-m ESA Optical Ground Station has been made available for NEO observations for four nights every month starting in 2010. Full operational services are to be implemented in 2012-2019. Ref: - Z. Sodnik, B. Furch, H.Lutz, Nov 2007, <i>ESA Bulletin</i> , No. 132, p. 34, "The ESA Optical Groundstation, ten years since First Light." See: http://www.esa.int/esapub/bulletin/bulletin132/bul132d_sodnik.pdf On 28/29 September 2011, a NEA was detected in this program for the first time: 2011 SF108 , by the Teide Observatory Tenerife Asteroid Survey (TOTAS) . See: http://www.esa.int/SPECIALS/SSA/SEMURW6UXSG_0.html http://www.esa.int/SPECIALS/SSA/SEMDQGCKP6G_2.html See also: http://www.esa.int/esaMI/Operations/SEMDPU3Z2OF_0.html http://www.esa.int/esaMI/SSA/SEMDQGCKP6G_0.html http://www.unoosa.org/pdf/pres/stsc2009/tech-13.pdf http://www.unoosa.org/pdf/pres/stsc2010/tech-36.pdf http://www.space.com/news/asteroid-threat-global-action-plan-101109.html
2008, Nov 3	Apollo NEA 2008 VM ($H = 30.2$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.120 LD (and the Moon at 0.985 LD). Minimum miss distance 0.112 LD. [2008-20] See: 2008 VM - SSA , 2008 VM - JPL
2008, Nov 9	Apollo NEA 4179 Toutatis (1989 AC , $H = 15.2$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, orbital $P = 4.03$ yr, PHA) passed Earth at 19.6 LD. See: 4179 Toutatis - SSA , 1989 AC - JPL See also: http://en.wikipedia.org/wiki/4179_Toutatis See also: 8 Dec 1992 , 30 Nov 1996 , 31 Oct 2000 , 29 Sep 2004 , 12 Dec 2012 , 5 Nov 2069 .
2008, Nov 16	Apollo NEA 2008 WO2 ($H = 29.8$ mag, $D \approx 5$ m) passed Earth at a

	nominal miss distance of 1.05 LD. Minimum miss distance 1.04 LD. See: 2008 WO2 - SSA , 2008 WO2 - JPL
2008, Nov 19-20	Workshop on the Early Solar System Impact Bombardment , Houston (TX, USA), 19-20 November 2008. See: http://www.lpi.usra.edu/meetings/bombardment2008/
2008, Nov 20	Buzzard Coulee Fireball and Meteorite Fall (Saskatchewan, Canada). Estimated NEA entry mass $M \approx 15,000$ kg. Ref: - A.R. Hildebrand, E.P. Miley, P.G. Brown, et al., 2009, 40 th Lunar and Planetary Science Conference, <i>Lunar and Planetary Science XL</i> , 23-27 March 2009, The Woodlands (TX, USA), id. 2505, "Characteristics of a bright fireball and meteorite fall at Buzzard Coulee , Saskatchewan (Canada), 20 November 2008." See: http://adsabs.harvard.edu/abs/2009LPI....40.2505H See also: http://antwarp.gsfc.nasa.gov/apod/ap081125.html
2008, Dec	L.A.M. Benner, S.J. Ostro, C. Magri, 2008, <i>Icarus</i> , 198, 294, "Near-Earth asteroid surface roughness depends on compositional class." See: http://adsabs.harvard.edu/abs/2008Icar..198..294B
2008, Dec	M.B.E. Boslough, D.A. Crawford, 2008, <i>International Journal of Impact Engineering</i> , 35, 1441, "Low-altitude airbursts and the impact threat." See: https://ui.adsabs.harvard.edu/abs/2008IJIE...35.1441B/abstract http://www.sandia.gov/ldrd/images/Posters/Boslough_Poster.pdf
2008, Dec	M.B.E. Boslough, A.W. Harris, 2008, in: <i>American Geophysical Union Fall Meeting 2008</i> , abstract #U41D-0034, "Global catastrophes in perspective: asteroid impact vs. climate change." See: http://adsabs.harvard.edu/abs/2008AGUFM.U41D0034B
2008, Dec	S. His, P. Garretson, et al., 2008, AF/A8XC, Natural impact hazard (asteroid strike) interagency deliberate planning exercise after action report, December 2008. See: https://cneos.jpl.nasa.gov/doc/Natural_Impact_After_Action_Report.pdf See also: https://cneos.jpl.nasa.gov/doc/niaa_summary2008.html
2008, Dec	G.R. Osinsky, J. Kieniewicz, J.R. Smith, M.B.E. Boslough, et al., 2008, <i>Meteoritics & Planetary Science</i> , 43, 2089, "The Dakhleh Glass : product of an impact airburst or cratering event in the Western Desert of Egypt?" See: http://adsabs.harvard.edu/abs/2008M%26PS...43.2089O

2008, Dec	M. Zavodny, R. Jedicke, E.C. Beshore, et al., 2008, <i>Icarus</i> , 198, 284, "The orbit and size distribution of small Solar System objects orbiting the Sun interior to the Earth's orbit." See: http://adsabs.harvard.edu/abs/2008Icar..198..284Z
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2008, Dec 6	Apollo NEA 2008 XK ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 1.60 LD. Minimum miss distance 0.08 LD. See: 2008 XK - SSA , 2008 XK - JPL
2008, Dec 6	Colorado Fireball . See: http://www.universetoday.com/21959/exploding-colorado-fireball-100-times-brighter-than-the-moon-video/
2008, Dec 6	Panoramic Survey Telescope And Rapid Response System (Pan-STARRS) , first telescope PS1 (Haleakala, Maui, HI, USA) operational, of four 1.8m telescopes, each with 3° FoV and 1.4 gigapixel camera. The PS2 telescope is under construction. The PS3 and PS4 telescopes are as yet uncertain. With PS1 the available sky is being observed three times per month down to $v = 24$ mag. Regular observations started in March 2009, were suspended in September 2009, but resumed in May 2010. The favored location for PS4 is the site of the University of Hawaii 2.2-meter telescope on Mauna Kea. Funding for the development of the observing system has been provided by the U.S. Air Force. Ref: - R. Irion, 12 May 2006, <i>Science</i> , 312, 840, "A Hawaiian upstart prepares to monitor the starry heavens." See: http://www.sciencemag.org/content/312/5775/840.summary/ - R. Jedicke, E.A. Magnier, N. Kaiser, et al., 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), <i>Proc. IAU Symp. No. 236 on Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i> , Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 341, "The next decade of Solar System discovery with Pan-STARRS ." See: http://adsabs.harvard.edu/abs/2007IAUS..236..341J - W. Burgett, N. Kaiser, 2009, in: S. Ryan (ed.), <i>Proc. Advanced Maui Optical and Space Surveillance Technologies Conference</i> , Wailea (Maui, HI, USA), 1-4 September 2009 (The Maui Economic Development Board), p. E39, "The Pan-STARRS Project: the next generation of survey astronomy has arrived." See:

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2008, Dec 10	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) Action Team 14, <i>Interim Report (2008 – 2009)</i>. See: http://www.unoosa.org/pdf/limited/c1/AC105_C1_L298E.pdf
2008, Dec 15	Steven J. Ostro (1946-2008) passed away. Ref: - C. Anderson, 2008, <i>Planetary News: Space People</i> (2008), 16 December 2008, "Steven J. Ostro, 1946 - 2008." See: http://www.planetary.org/news/2008/1216_Steven_J_Ostro_1946_2008.html - K. Beatty, 2008, <i>Sky & Telescope</i>, 18 December 2008, "Remembering Steven Ostro", See: http://www.skyandtelescope.com/community/skyblog/newsblog/36421054.html - D. Morrison, 2008, <i>Asteroid and Comet Impact Hazards</i>, 30 December 2008, "Death of Steve Ostro (1946-2008)." See: - A.W. Harris, 2009, American Astronomical Society, DPS meeting #41, #29.01, "Steven J. Ostro: Pioneer in asteroid lightcurve inversion." See: http://adsabs.harvard.edu/abs/2009DPS....41.2901H See also: http://www.planetary.org/blog/article/00001774 http://www.planetary.org/blog/article/00001976/ http://echo.jpl.nasa.gov/ostro_symposium/ostro_symposium.html http://en.wikipedia.org/wiki/Steven_J._Ostro
2008, Dec 23	Aten NEA 341843 (2008 EV5, $H = 19.9$ mag, $D = 370$ m, PHA) passed Earth at a nominal miss distance of 8.41 LD. Minimum miss distance 8.41 LD. See: 341843 2008 EV5 - SSA , 2008 EV5 - JPL Ref: - M.W. Busch, S.J. Ostro, L.A.M. Benner, et al., 2011, <i>Icarus</i>, 212,

	649, "Radar observations and the shape of Near-Earth Asteroid 2008 EV5." See: http://adsabs.harvard.edu/abs/2011Icar..212..649B - V. Reddy, L. LeCorre, M. Hicks, et al., 2012, <i>Icarus</i>, 221, 678, "Composition of Near-Earth Asteroid 2008 EV5: potential target for robotic and human exploration." See: http://adsabs.harvard.edu/abs/2012Icar..221..678R See also: http://www.activeboard.com/forum.spark?forumID=58381&p=3&topicID=23138860 https://en.wikipedia.org/wiki/(341843)_2008_EV5
2009, Jan 1	5864 NEAs known, of which 1008 PHAs. See: http://neo.jpl.nasa.gov/stats/
2009	The Space Generation Advisory Council (SGAC), Vienna, (Austria), in the context of the <i>International Year of Astronomy 2009</i>, launched its initiative <i>Move an Asteroid 2009</i>. The Winner of the competition, announced on 26 August 2009, is Sini Merikallio of the Finnish Meteorological Institute, Helsinki (Finland) with the paper: "Moving an asteroid with electric solar wind sail". See: http://www.spacegeneration.org/asteroid
2009	The IAU Minor Planet Center is funded over 90% through a grant from NASA's Planetary Science Division. This grant enabled the MPC to hire two additional staff members, and will support funding at this level for the next 2.5 years. The MPC is operated at the Harvard-Smithsonian Astrophysical Observatory, Cambridge (MA, USA) and supported by the IAU and sponsors, including the Tamkin Foundation. The MPC is responsible for the collection, validation and distribution of all positional measurements made worldwide of minor planets, comets and other irregular natural satellites. While the MPC handles data on all classes of object, it focuses on the rapid collection and distribution of observations and information on the orbits of NEOs. The MPC is now fully upgraded to LINUX-based processors; it processes all observations received world-wide each night within the next day; its database contains over 68,000,000 observations and over 475,000 orbits for minor planets. NEO observations are identified and processed on receipt in near-real-time. Suspected discoveries are automatically posted to the NEO Confirmation Page. Since June 2018 the IAU Minor Planet Center is operating under the NASA Planetary Data System's Small Bodies Node. See: http://www.cfa.harvard.edu/iau/mpc.html http://www.unoosa.org/pdf/pres/stsc2010/tech-39.pdf http://targetneo.jhuapl.edu/pdfs/sessions/TargetNEO-Session2-Spah.pdf

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2009, Jan	International Academy of Astronautics (IAA) report <i>Dealing with the threat to Earth from Asteroids and Comets</i> , Ivan Bekey (ed.). See: http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finalreport.pdf
2009, Jan 2	R.A. Kerr, 2009, <i>Science</i> , 323, 26, "Did the mammoth slayer leave a diamond calling card?" See: http://www.sciencemag.org/content/323/5910/26.summary
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2009, Feb 2	Apollo NEA 2009 CC2 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.46 LD. [2009-01] See: 2009 CC2 - SSA , 2009 CC2 - JPL
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2009, Feb 16	I. Bekey, study chairman, 2009, "Dealing with the threat to earth from asteroids and comets -- synopsis of a NEO study by the International Academy of Astronautics (IAA)." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-29.pdf
2009, Feb 16-17	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Scientific and Technical Subcommittee, 46th Session, Action Team 14 on NEOs under the Chairmanship of Richard Crowther (UK) met in Vienna (Austria) during the 46th session of its Scientific and Technical Subcommittee, to review the Association of

	Space Explorers (ASE) Committee on Near-Earth Objects Panel on Asteroid Threat Mitigation (chair Russell L. Schweickart) report <i>Asteroid Threats: a Call for Global Response</i> (see 25 September 2008), and as a result developed UN document A/AC.105/C.1/2009/CRP.13 dated 17 February 2009, outlining draft international procedures to respond to NEO threat for consideration by UN-COPUOS Member States. Report, 6 March 2009: http://www.unoosa.org/pdf/reports/ac105/AC105_933E.pdf http://www.unoosa.org/pdf/limited/c1/AC105_C1_2009_CRP13E.pdf Technical presentations: - Boris Shustov, 2009, "Asteroid-comet impact hazard problem. Current state of art in Russia." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-24.pdf - L. Johnson (NASA), 2009, "Near Earth Object Observations Program." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-25.pdf - Canadian Space Agency, 2009, "Near Earth Objects Surveillance Satellite (NEOSSat)." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-26.pdf - J.-Y. Prado (CNES), 2009, "French activities related to Apophis." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-27.pdf - I. Bekey (IAA), 2009, "Dealing with the threat to earth from asteroids and comets." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-29.pdf - R. Schweickart, 2009, "Asteroid Threats: A Call for Global Response." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-30.pdf - A. Harris, 2009, "Assessment of the proposal <i>Asteroid Threats: A Call for Global Response</i> by the Association of Space Explorers panel on asteroid threat mitigation." See: http://www.unoosa.org/pdf/pres/stsc2009/tech-31.pdf See also: http://otrans.3cdn.net/d564a979a458d455eb_1flm6pc5h.pdf http://www.newswise.com/articles/view/546932/?sc=dwtr:xy=5028369
2009, Feb 18	Aten NEA 208023 (1999 AQ10, $H = 20.6$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 4.39 LD. Minimum miss distance 4.39 LD. See: 1999 AQ10 - JPL , 1999 AQ10 - SSA See also 18 Feb 1903.
2009, Feb 26	Apollo NEA 2009 DT43 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 1.03 LD. Minimum miss distance 1.03 LD. See: 2009 DT43 - SSA , 2009 DT43 - JPL
2009, Feb 27	Apollo NEA 2009 EJ1 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a

	nominal miss distance of 0.16 LD. Minimum miss distance 0.15 LD. [2009-02] See: 2009 EJ1 - SSA , 2009 EJ1 - JPL
2009, Mar	M. di Martino, A. Carbognani, A. Cellino, et al., 2009, <i>The Asteroid Hazard - Evaluating and Avoiding the Threat of Asteroid Impacts</i> , ESA SP-1310 (Noordwijk: ESA Communication Production Office). Translated and updated from M. Di Martino (ed.), 2005, <i>Il Rischio Asteroid</i> . See: http://adsabs.harvard.edu/abs/2009ESASP1310.....D
2009, Mar	A.C. Charania, 2009, in: <i>Space, Propulsion & Energy Sciences International Forum: SPESIF-2009, AIP Conf. Proc.</i> , 1103, 393, "Initial assessment of recent NEO response strategies for the United Nations." See: http://adsabs.harvard.edu/abs/2009AIPC.1103..393C http://www.astrosociology.org/Library/PDF/Charania_SPESIF2009.pdf
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2009, Mar 2	Apollo NEA 2009 DD45 ($H = 25.9$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2009-03] See: 2009 DD45 - SSA , 2009 DD45 - JPL See also: http://www.newscientist.com/article/dn16697-tunguskasized-space-rock-buzzes-earth.html http://news.sky.com/skynews/Home/UK-News/Earth-Has-Near-Miss-As-Asteroid-Passes-50000-Miles-Away/Article/200903115234146?lpos=UK_News_First_Home_Article_Teaser_Region_0&lid=ARTICLE_15234146_Earth_Has_Near_Miss_As_Asteroid_Passes_50%2C000_Miles_Away http://en.wikipedia.org/wiki/2009_DD45 See also: 3 March 2007 .
2009, Mar 6	Apollo NEA 2009 EW ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.88 LD. [2009-04] See: 2009 EW - SSA , 2009 EW - JPL
2009, Mar 16	Apollo NEA 2009 FJ ($H = 24.7$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 4.92 LD. Minimum miss distance 4.91 LD. See: 2009 FJ - SSA , 2009 FJ - JPL

	Ref: - I. Włodarczyk, 2012, <i>Solar System Research</i>, 46, 301, "Impact orbits of the asteroid 2009 FJ with the Earth." See: http://adsabs.harvard.edu/abs/2012SoSyR..46..301W
2009, Mar 18	Apollo NEA 2009 FH ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.22 LD. Minimum miss distance 0.22 LD. [2009-05] See: 2009 FH - SSA , 2009 FH - JPL
2009, Mar 19	Apollo NEA 2009 FK ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.98 LD. Minimum miss distance 0.97 LD. [2009-06] See: 2009 FK - SSA , 2009 FK - JPL
2009, Mar 27	Brian G. Marsden (Minor Planet Center emeritus-director), June 2009, <i>IAU Information Bulletin</i> No. 104, p. 67, "History of the Minor Planet Center." At the time of writing, the MPC files counted 210,454 numbered minor planets. The total number of observations of minor planets in the MPC files in mid-2008 was 55.4 million. See: http://www.iau.org/static/publications/IB104.pdf
2009, Mar 27	Apollo NEA 410777 (2009 FD, $H = 22.3$ mag, $D \approx 472$ m) passed Earth at a nominal miss distance of 1.62 LD. Minimum miss distance 1.62 LD. See: 410777 2009 FD - SSA, 2009 FD - JPL See also: http://www.space.com/12645-asteroid-deflection-doomsday-earth-capability.html http://www.eso.org/public/announcements/ann14004/ http://neo.ssa.esa.int/ http://www.esa.int/Our_Activities/Operations/Space_Situational_Awareness/European_cooperation_reduces_asteroid_risk http://en.wikipedia.org/wiki/2009_FD See also: 29 Mar 2185.
2009, Apr	R.P. Binzel, A.S. Rivkin, C.A. Thomas, et al., 2009, <i>Icarus</i>, 200, 480, "Spectral properties and composition of potentially hazardous asteroid (99942) Apophis." See: http://adsabs.harvard.edu/abs/2009Icar..200..480B
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	<i>Opportunities – Legal Aspects</i>, University of Nebraska-Lincoln, Lincoln (NE, USA), hosted by Frans G. von der Dunk. See: http://conferences.unl.edu/nearearthobject/ http://spaceandtelecomlaw.unl.edu/conferences/lincolnconference/archive http://www.unoosa.org/pdf/pres/stsc2010/tech-25.pdf
2009, Apr 24	L. Lucchetti, 2009, <i>LLNL Community News - Lab News</i> 2(16), "Averting asteroid danger with a nuclear nudge." See: http://www.scientificamerican.com/blog/post.cfm?id=back-off-asteroids--weve-got-nukes-2010-05-26 http://www.space.com/8666-nuclear-bombs-save-earth-asteroids.html
2009, Apr 24	Apollo NEA 2009 HW67 ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 1.05 LD. Minimum miss distance 1.04 LD. See: 2009 HW67 - SSA , 2009 HW67 - JPL
2009, Apr 27-30	1st International Academy of Astronautics (IAA) Planetary Defense Conference: Protecting the Earth from Asteroids, Granada (Spain), co-sponsored by ESA and The Aerospace Corporation. See: http://pdc.iaaweb.org/?q=content/2009-granada Key points and recommendations: http://www.nss.org/resources/library/planetary_defense/WhitePaper-2009PlanetaryDefenseConference.pdf Among the papers: - D.K. Yeomans, S. Bhaskaran, S.B. Broschart, S.R. Chesley, P.W. Chodas, T. H. Sweetser, R. Schweickart, 2009, "Deflecting a Hazardous Near-Earth Object." See: https://cneos.jpl.nasa.gov/doc/PDC_proceedings_062009.pdf https://cneos.jpl.nasa.gov/doc/PDC2015_paper.html
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	153, "Radar observations and a physical model of asteroid 4660 Nereus, a prime space mission target." Apollo NEA, 4660 Nereus, 1982 DB, $H = 18.5$, $D \approx 510 \times 330 \times 240$ m, PHA. See: http://adsabs.harvard.edu/abs/2009Icar..201..153B
2009, May	L. Lyytinen, L. Jetsu, P. Kajatkari, S. Porceddu, 2009, <i>Astronomy & Astrophysics</i>, 499, 601, "Detection of real periodicity in the terrestrial impact crater record: quantity and quality requirements." See: http://adsabs.harvard.edu/abs/2009A%26A...499..601L
2009, May 5	Apollo NEA 2009 JF1 ($H = 27.1$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.76 LD. Minimum miss distance 0.76 LD. [2009-07] See: 2009 JF1 - SSA , 2009 JF1 - JPL
2009, May 9	Apollo NEA 2009 JE1 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 6.06 LD. Minimum miss distance 0 LD. See: 2009 JE1 - SSA , 2009 JE1 - JPL
2009, May 10-15	<i>International Conference on Bolides and Meteorite Falls</i>, Prague, Czech Republic. See: http://www.bolides09.com/docs/bolides09_program.pdf
2009, May 13	A. Nayar, 2009, <i>Nature News</i>, 13 May 2009, "Did dinosaur-killing space rock create enough carbon monoxide to trigger extreme global warming?" See: http://www.nature.com/news/2009/090513/full/news.2009.477.html
2009, May 13	Apollo NEA 2009 JL2 ($H = 25.8$ mag, $D \approx 24$ m) passed Earth at a nominal miss distance of 0.69 LD. Minimum miss distance 0.69 LD. [2009-08] See: 2009 JL2 - SSA , 2009 JL2 - JPL See also: http://www.scientificamerican.com/blog/post.cfm?id=newfound-asteroid-will-pass-by-eart-2010-04-08
2009, May 18-20	ESA International Symposium <i>Marco Polo and Other Small Body Return Missions</i>, Paris, France. See: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=43784
2009, May 21	O. Abramov, S.J. Mojzsis, 2009, <i>Nature</i>, 459, 419, "Microbial habitability of the Hadean Earth during the Late Heavy Bombardment." Ancient asteroid storm may have aided the emergency of life. See: http://adsabs.harvard.edu/abs/2009Natur.459..419A See also: http://planetary.org/news/2009/0529_Ancient_Asteroid_Storm_May_

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2009, Jun	B.G. Marsden, 2009, <i>IAU Information Bulletin</i>, No.104, p. 67, "History of the Minor Planet Center." See: http://www.iau.org/static/publications/IB104.pdf
2009, Jun 1	Apollo NEA 2009 KR21 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.74 LD. Minimum miss distance 0.72 LD. [2009-09] See: 2009 KR21 - SSA , 2009 KR21 - JPL
2009, Jun 3-12	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS, 52nd session) and Action Team 14 on NEOs, chaired by Richard Crowther (UK), meets in Vienna (Austria). See: http://www.oosa.unvienna.org/pdf/gadocs/A_64_20E.pdf
2009, Jun 4	Steven J. Ostro Memorial Symposium on Planetary Radar and Near-Earth Objects, JPL, Pasadena (CA, USA). Ref: - S.J. Ostro, J.D. Giorgini, L.A.M. Benner, 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), <i>Proc. IAU Symp. No. 236 on Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i>, Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 143, "Radar reconnaissance of near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2007IAUS..236..143O See also: http://echo.jpl.nasa.gov/ostro_symposium/ostro_symposium.html http://www.planetary.org/blog/article/00001976/
2009, Jun 5	ESA <i>Space Science</i>, 5 June 2009, ESA Mars Express, "Craters and channels in Hephaestus Fossae." See: http://www.esa.int/esaSC/SEMSKCVTGVE_index_0.html
2009, Jun 10	L. David, 2009, <i>Space.com</i>, "Military hush-up: incoming space rocks now classified." See: http://www.space.com/news/090610-military-fireballs.html
2009, Jun 10	Apollo NEA 136617 (1994 CC), $H = 18.1$ mag, $D \approx 600$ m, (PHA) passed Earth at a nominal miss distance of 6.55 LD. Minimum miss

	distance 6.55 LD. Observed with NASA Goldstone Solar System Radar (CA, USA). The asteroid appeared to be a triple system, each of the two moons having $D \approx 50$ m. See: 136617 1994 CC - SSA , 1994 CC - JPL Ref: - J. Fang, J.-L. Margot, M. Brozovic, et al., 2011, <i>Astronomical Journal</i>, 141, 154, "Orbits of Near-Earth Asteroid triples 2001 SN263 and 1994 CC: properties, origin, and evolution." See: http://adsabs.harvard.edu/abs/2011AJ....141..154F - M. Brozović, L.A.M. Benner, P.A. Taylor, et al., 2011, <i>Icarus</i>, 216, 241, "Radar and optical observations and physical modeling of triple near-Earth Asteroid (136617) 1994 CC." See: http://adsabs.harvard.edu/abs/2011Icar..216..241B See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2259 https://cneos.jpl.nasa.gov/news/news199.html http://en.wikipedia.org/wiki/(136617)_1994_CC
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2009, Jul 3	L. David, 2009, <i>Space.com</i>, "Military seeks common ground with scientists on Fireball data flap." See: http://www.space.com/news/090610-military-fireballs.html
2009, Jul 13	Review of report <i>Defending Planet Earth: Near-Earth Object Surveys and Hazard Mitigation Strategies</i>, Survey/Detection Panel, Santa Fe (NM, USA). See: http://www8.nationalacademies.org/cp/meetingview.aspx?MeetingID=3445&MeetingNo=4 http://www.nap.edu/catalog.php?record_id=12842
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2009, Oct 5	Apollo NEA 2009 TD17 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.67 LD. Minimum miss distance 0.67 LD. [2009-11] See: 2009 TD17 - SSA , 2009 TD17 - JPL See also: 23 Apr 1992, 7 May 2039
2009, Oct 7	NASA scientists refine asteroid Apophis ' path toward Earth . Updated computational techniques and newly available data indicate the probability of an Earth encounter on April 13, 2036, for Apophis has dropped from one-in-45,000 to about four-in-a million. See: http://neo.jpl.nasa.gov/news/news164.html
2009, Oct 8	G. Musser, 2009, <i>Scientific American</i> , p. 109, "Planetary bombardments, past and future: third dispatch from the annual planets meeting." See: http://blogs.scientificamerican.com/observations/2009/10/08/planetary-bombardments-past-and-future-third-dispatch-from-the-annual-planets-meeting/
2009, Oct 8, 02:56	Apollo NEA 2016 QE45 , $H = 21.8$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 3.75 LD. Minimum miss distance 3.75 LD. See: 2016 QE45 - JPL , 2016 QE45 - SSA
2009, Oct 8, 23:50	Apollo NEA 2009 TU ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.79 LD. Minimum miss distance 0.79 LD. [2009-12] See: 2009 TU - SSA , 2009 TU - JPL
2009, Oct 8	Bone Fireball (South Sulawesi, Indonesia), a bolide exploding with an energy of 40-50 kT TNT. Incoming object probably with $D \approx 5 - 10$ m. See: http://neo.jpl.nasa.gov/news/news165.html#report http://www.youtube.com/watch?v=yeQBzTkJNhs&videos=jkRJgbXY-90 http://www.skyandtelescope.com/news/65960457.html http://lunarmeteoritehunters.blogspot.com/2009/10/indonesia-meteorite-news.html http://www.technologyreview.com/blog/arxiv/25991/?p1=A3 Ref:

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2009, Oct 12-16	International Symposium on Hazardous Near Earth Asteroids, Valletta (Malta). Organized by the Russian Academy of Sciences, with the support and participation of ESA. See: http://nea2009.cosmos.ru/ http://iya2009malta.page.tl/International-Symposium-on-Near_Earth-Hazardous-Asteroids.htm
2009, Oct 13	Netherlands fireball. Hundred of people in the Netherlands and Germany reported seeing a fireball streak across the twilight sky around 7 p.m. See: http://www.planetary.org/blog/article/00002166/ http://news.nationalgeographic.com/news/2009/10/091015-fireball-explodes-netherlands-germany-picture.html http://apod.nasa.gov/apod/ap091015.html
2009, Oct 17	Apollo NEA 2009 TM8 ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.90 LD. Minimum miss distance 0.90 LD. [2009-13] See: 2009 TM8 - SSA , 2009 TM8 - JPL See also: 17 Oct 2011.
2009, Oct 22	Presentation of the Review of the U.S. Human Spaceflight Plans Committee, chair Norman R. Augustine: <i>Seeking a Human Spaceflight Program Worthy of a Great Nation</i>. The Review suggests manned spaceflight to an NEA, among other future destinations for exploration. See: http://www.nasa.gov/offices/hsf/meetings/10_22_pressconference.html http://www.nasa.gov/pdf/396093main_HSF_Cmte_FinalReport.pdf
2009, Oct 24	M. di Martino, 2009, in: Ecole Internationale Daniel Chalonge, Torino Cosmology Colloquium <i>Latest news from the Universe</i>, Turin, 21-24 October 2009, p. 17, "Discovery of a recent impact crater." See: http://adsabs.harvard.edu/abs/2009Inu..confE..17D
2009, Nov	R. Firestone, 2009, <i>Journal of Cosmology</i>, 2, 256, "The case for the Younger Dryas extraterrestrial impact event: mammoth, megafauna and Clovis extinction."

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2009, Nov 6	Apollo NEA 2009 VA ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.053 LD ($= 3.21 R_{\text{Earth}}$ from the geocenter). Minimum miss distance 0.042 LD. [2009-14] Discovered 15 hours before closest approach. Third closest (non-impacting) Earth approach on record for catalogued asteroids. See: 2009 VA - SSA , 2009 VA - JPL See also: http://neo.jpl.nasa.gov/news/news166.html http://en.wikipedia.org/wiki/2009_VA
2009, Nov 9-11	<i>First Arab Impact Cratering and Astrogeology Conference</i> , Amman (Jordan), 9-11 November 2009. See: http://www.aaru.edu.jo/index.php?option=com_content&task=view&id=229&Itemid=38 http://adsabs.harvard.edu/abs/2010M%26PS...45..157R
2009, Nov 10	Apollo NEA 2020 VP1 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 9.56 LD. Minimum miss distance 0.13 LD. See: 2020 VP1 – S2P , 2020 VP1 - JPL
2009, Nov 12	Apollo NEA 2009 VZ39 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.68 LD. Minimum miss distance 0.02 LD. [2009-15] See: 2009 VZ39 - SSA , 2009 VZ39 - JPL
2009, Nov 15	Apollo NEA 2009 WP6 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.69 LD. Minimum miss distance 0.68 LD. [2009-16] See: 2009 WP6 - SSA , 2009 WP6 - JPL
2009, Nov 16	Aten NEA 2009 WQ6 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2009-17] See: 2009 WQ6 - SSA , 2009 WQ6 - JPL See also: 18 Nov 2189 .
2009, Nov 18	Utah Fireball . A remarkable midnight fireball was seen over parts of the western USA: Utah, Wyoming and Idaho, that "turned night into day". Infrasound measurements suggest a sporadic asteroid not associated with the Leonid debris stream of 17 November. The space rock exploded in the atmosphere with an energy equivalent to 0.5 - 1

	kT TNT. See: http://www.spaceweather.com/archive.php?view=1&day=18&month=11&year=2009 http://video.google.com/videosearch?q=Fireball+Utah,+November+18+2009&rls=com.microsoft:en-us&oe=UTF-8&rlz=1I7ADBF_nl&um=1&ie=UTF-8&ei=3t2MS5b_BMzc-Qa13NDjDQ&sa=X&oi=video_result_group&ct=title&resnum=4&ved=0CBMQwQwAw#
2009, Nov 18-19	Second NASA Small Bodies Assessment Group Meeting, Boulder (CO, USA). See: http://www.lpi.usra.edu/sbag/meetings/ http://www.lpi.usra.edu/sbag/meetings/sbag2/agenda.shtml http://www.lpi.usra.edu/sbag/meetings/sbag2/meeting_notes_091119.pdf Findings: https://www.lpi.usra.edu/sbag/findings/
2009, Nov 20	Apollo NEA 2009 WJ6 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.46 LD. Minimum miss distance 0.46 LD. [2009-18] See: 2009 WJ6 - SSA , 2009 WJ6 - JPL See also: 21 Nov 2063.
2009, Nov 24	Apollo NEA 2009 WV51 ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2009-19] See: 2009 WV51 - SSA , 2009 WV51 - JPL
2009, Nov 27	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Action Team 14 on Near-Earth Objects, <i>Interim Report (2009 – 2010)</i>. See: http://www.unoosa.org/pdf/limited/c1/AC105_C1_L301E.pdf
2009, Nov-Dec	R.L. Schweickart, 2009, <i>Acta Astronautica</i>, 65, 1402, "Decision program on asteroid threat mitigation", See: http://adsabs.harvard.edu/abs/2009AcAau..65.1402S
2009, Dec	C.R. Chapman, 2009, <i>American Geophysical Union, Fall Meeting 2009</i>, abstract #SA12B-03, "Asteroids shedding meteoroids...or becoming bolides." See: http://adsabs.harvard.edu/abs/2009AGUFMSA12B..03C
2009, Dec	A.W. Harris, 2009, <i>American Geophysical Union, Fall Meeting 2009</i>, abstract #PP33B-05, "Cosmic impact: what are the odds?" See: http://adsabs.harvard.edu/abs/2009AGUFMPP33B..05H

2009, Dec	U.G. Jørgenson, P.W.U. Appel, Y. Hatsukawa, R. Frei, M. Oshima, Y. Toh, A. Kimura, 2009, <i>Icarus</i> , 204, 368, "The Earth-Moon system during the late heavy bombardment period - Geochemical support for impacts dominated by comets." See: http://adsabs.harvard.edu/abs/2009Icar..204..368G
2009, Dec	R.R. Landis, P.A. Abell, D.J. Korsmeyer, et al., 2009, <i>Acta Astronautica</i> , 65, 1689, "Piloted operations at a near-Earth object (NEO)." See: http://adsabs.harvard.edu/abs/2009AcAau..65.1689L
2009, Dec	D.K. Yeomans, A. Chamberlin, S. Chesley, P.W. Chodas, 2009, <i>American Geophysical Union, Fall Meeting 2009</i> , abstract #NH32A-02, "Issues that drive Near-Earth Object mitigation responses." See: http://adsabs.harvard.edu/abs/2009AGUFMNH32A..02Y
2009, Dec 1	ESA Marco Polo assessment study report (SRE-2009-3), a NEA sample return mission, presented. Six year mission, 17 months at the asteroid. Junior partners: JAXA (from Hayabusa heritage: guidance, navigation and control) and NASA (SALMON: hardware and software components). Mission profile: launch Nov/Dec 2018; rendezvous with NEA 162173 (1999 JU3) , $H = 19.18$ mag, $D \approx 920$ m, PHA) in February 2022; return to Earth in December 2024. Ref: - H. Campins, J.P. Emery, M. Kelley, et al., 2009, <i>Astronomy & Astrophysics (Letters)</i> , 503, L17, " Spitzer observations of spacecraft target 162173 (1999 JU3) "; See: http://adsabs.harvard.edu/abs/2009A%26A...503L..17C - T.G. Müller, J. Durech, S. Az, et al., 2011, <i>Astronomy & Astrophysics</i> , 525, id.A145, "Thermo-physical properties of 162173 (1999 JU3) , a potential flyby and rendezvous target for interplanetary missions." See: http://adsabs.harvard.edu/abs/2011A%26A...525A.145M See also: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=46019# http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=44880 On 26 January 2010, the project has been shelved by ESA.
2009, Dec 5-15	Workshop on asteroid 2008 TC3 , University of Khartoum (Khartoum, Sudan). See: http://asima.seti.org/2008TC3/workshop2008TC3.html
2009, Dec 13/14	Geminids meteor shower , having its origin from Apollo NEA 3200 Phaethon (1983 TB) , $H = 14.4$ mag, $D \approx 5.1 \pm 0.2$ km, PHA). The asteroid has a trail of pebble- and dust-sized debris, causing a meteor shower when Earth crosses the trail. Asteroid 3200 Phaethon was

	detected by IRAS on 11 October 1983. It approaches the Sun closer than any other numbered asteroid: its perihelion is 0.14 AU, less than half Mercury's perihelion distance. 3200 Phaethon is possibly an old comet core. Its closest to Earth within the next 190 yr will occur on 14 December 2093 at 7.7 LD. Ref: - G.O. Ryabova, May 2012, <i>Monthly Notices Royal Astronomical Society</i>, 423, 2254, "On the possible ejection of meteoroids from asteroid (3200) Phaethon in 2009." See: http://adsabs.harvard.edu/abs/2012MNRAS.423.2254R See also: http://www.space.com/10467-geminids-shower-meteor-gems-skywatchers-week.html http://apod.nasa.gov/apod/ap091217.html http://apod.nasa.gov/apod/ap091219.html http://en.wikipedia.org/wiki/Geminids http://en.wikipedia.org/wiki/3200_Phaethon
2009, Dec 14	Launch of NASA Wide-field Infrared Survey Explorer (WISE). The WISE instrument is a four-channel imager which operates in a single mode, taking overlapping snapshots of the sky. It includes a 40-cm telescope; a 47' FoV; 1024² HgCdTe and Si:As detector arrays at 3.4, 4.6, 12, and 22 μm; a resolution of 6" (12" at 22 μm); a two-stage solid-hydrogen cryostat with an expected 10-month lifetime. WISE will detect hundreds of thousands of asteroids. Some 100,000 previously unknown main-belt asteroids with $D > 3$ km in diameter and some 200 new NEAs, with diameters $D > \sim 100$ m, are expected to be discovered during the six-month prime mission of WISE. NEO-WISE is a program to identify previously unknown moving object candidates and report them promptly to the Minor Planet Center so that they can be recovered with ground-based telescopes during their discovery apparitions. Ref: - E.L. Wright, P.R.M. Eisenhardt, A.K. Mainzer, et al., 2010, <i>Astronomical Journal</i>, 140, 1868, "The Wide-field Infrared Survey Explorer (WISE): mission description and initial on-orbit performance." See: http://adsabs.harvard.edu/abs/2010AJ....140.1868W See also: http://adsabs.harvard.edu/abs/2009AAS...21345906M http://wise.ssl.berkeley.edu http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2460 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2612 http://neo.jpl.nasa.gov/stats/wise/ http://wise.ssl.berkeley.edu/documents/WISESPIE_2008.pdf?product_id=790087 http://www.lpi.usra.edu/sbag/meetings/sbag2/presentations/Mainzer_WISE.pdf

2009, Dec 18	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), <i>Information on research in the field of NEOs carried out by Member States, international organizations and other entities.</i> Document: A/AC.105/949. See: http://www.unoosa.org/pdf/reports/ac105/AC105_949E.pdf
2009, Dec 29	NASA selects three proposals as candidates for the agency's next space venture to another celestial body. After selection in mid-2011, the selected mission must be ready for launch no later than 30 December 2018. One of the three candidates is the Origins Spectral Interpretation Resource Identification Security Regolith Explorer (Osiris-REx), which would rendezvous and orbit an asteroid in 2020, possibly asteroid 101955 (1999 RQ36), $H = 20.8$ mag, $D = 575$ m, NEO, PHA). After extensive measurements, instruments would collect more than two ounces of material from the asteroid's surface for return to Earth. P.I.: Michael Drake, University of Arizona (Tucson, USA). See: http://osiris-rex.lpl.arizona.edu/ Ref: - A. Milani, S.R. Chesley, M.E. Sansaturio, et al., 2009, <i>Icarus</i>, 203, 460, "Long term impact risk for (101955) 1999 RQ." See: http://adsabs.harvard.edu/abs/2009Icar..203..460M - D.S. Lauretta, M.J. Drake, R.P. Binzel, et al., 2010, in: <i>73rd Annual Meeting of the Meteoritical Society</i>, 26-30 July 2010, New York (NY, USA), <i>Meteoritics and Planetary Science Supplement</i>, id.5153, "Asteroid (101955) 1999 RQ36: optimum target for an asteroid sample return mission." See: http://adsabs.harvard.edu/abs/2010M%26PSA..73.5153L - M. Delbò, P. Michel, 2011, <i>Astrophysical Journal (Letters)</i>, 728, L42, "Temperature history and dynamical evolution of (101955) 1999 RQ36: a potential target for sample return from a primitive asteroid." See: http://adsabs.harvard.edu/abs/2011ApJ...728L..42D - B.E. Clark, R.P. Binzel, E.S. Howell, et al., 2011, <i>Icarus</i>, 216, 462, "Asteroid (101955) 1999 RQ36: spectroscopy from 0.4 to 2.4 μm and meteorite analogs." See: http://adsabs.harvard.edu/abs/2011Icar..216..462C - J.P. Emery, M.S. Kelly, Y.R. Fernandez, et al., 2012, American Astronomical Society, DPS meeting #44, #102.05, "Thermal and physical characterization of the OSIRIS-REx target asteroid (101955) 1999 RQ36." See: http://adsabs.harvard.edu/abs/2012DPS....4410205E - M.C. Nolan, C. Magri, L.A.M. Benner, et al., October 2012, American Astronomical Society, DPS meeting #44, #110.02, "The shape of OSIRIS-REx mission target 1999 RQ36 from RADAR and lightcurve data."

	See: http://adsabs.harvard.edu/abs/2012DPS....4411002N - T.G. Müller, L. O'Rourke, A.M. Barucci, et al., December 2012, <i>Astronomy & Astrophysics</i>, 548, 36, "Physical properties of OSIRIS-REx target asteroid (101955) 1999 RQ36. Derived from Herschel, VLT/ VISIR, and Spitzer observations." See: http://adsabs.harvard.edu/abs/2012A%26A...548A..36M See also: http://www.jpl.nasa.gov/news/news.cfm?release=2009-205 http://uanews.org/node/29231 http://www.nasa.gov/topics/solarsystem/features/osiris-rex.html http://adsabs.harvard.edu/abs/2012LPI....43.2219H http://adsabs.harvard.edu/abs/2012LPI....43.2491L
2010, Jan 1	6644 NEAs known (ranging in size up to ~37 km: 1036 Ganymed, A924 UB, $H = 9.45$ mag, $D = 36.5$ km, Amor NEA), of which 1086 PHAs (ranging in size from 140 m up to ~5 km: 4179 Toutatis, 1989 AC, $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, Apollo NEA, PHA). See: http://neo.jpl.nasa.gov/stats/
2010	M. Birlan, O. Văduvescu, D.A. Nedelcu, EURONEAR Team, 2010, <i>Romanian Astronomical Journal</i>, 20, Supplement "Recent insights into our Universe", 119, "High-precision astrometry of NEAs via EURONEAR observations." See: http://adsabs.harvard.edu/abs/2010RoAJ...20S.119B
2010	A.W. Harris, 2010, in: A.M. Finkelstein, W.F. Huebner & V.A. Shor (eds.), <i>Proceedings Intern. Conf. Asteroid-Comet Hazard 2009, Protecting the Earth against collisions with asteroids and comet nuclei</i>, St. Petersburg (Russian Federation), 21-25 September 2009 (Saint Petersburg: Nauka), p. 312, "Estimating the NEO population and impact risk: past present and future."
2010	W.F. Huebner, D.C. Boice. P. Bradley, et al., 2010, in: A.M. Finkelstein, W.F. Huebner & V.A. Shor (eds.), <i>Proceedings Intern. Conf. Asteroid-Comet Hazard 2009, Protecting the Earth against collisions with asteroids and comet nuclei</i>, St. Petersburg (Russian Federation), 21-25 September 2009 (Saint Petersburg: Nauka), p. 337, "The engagement space for countermeasures against Potentially Hazardous Objects (PHOs)."
2010	T. Kwiatkowski, D.A.H. Buckley, D. O'Donoghue, et al., 2010, <i>Astronomy and Astrophysics</i>, 509, 94, "Photometric survey of the very small Near-Earth Asteroids with the SALT telescope. I. Lightcurves and periods for 14 objects." See: http://adsabs.harvard.edu/abs/2010A%26A...509A..94K
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	"Photometric survey of the very small Near-Earth Asteroids with the SALT telescope. II. Discussion of YORP." See: http://adsabs.harvard.edu/abs/2010A%26A...509A..95K
2010	T. Kwiakowski, M. Polinska, N. Loaring, et al., 2010, <i>Astronomy and Astrophysics</i>, 511, 49, "Photometric survey of the very small Near-Earth Asteroids with the SALT telescope. III. Lightcurves and periods for 12 objects and negative detections." See: http://adsabs.harvard.edu/abs/2010A%26A...511A..49K
2010	D. Lazzaro, 2010, <i>Boletín de la Asociación Argentina de Astronomía</i>, 53, 315, "Photometric and spectroscopic studies of small Solar System bodies and the IMPACTON project." See: http://adsabs.harvard.edu/abs/2010BAAA...53..315D The Brazilian IMPACTON project - Iniciativa de Mapeamento e Pesquisa de Asteróides nas Cercanias da Terra no Observatório Nacional - formally started in 2005 aiming to install and operate a robotic telescope dedicated to the follow-up and physical characterization of NEOs. See also: http://www.on.br/impacton/
2010	D.K. Yeomans, S.R. Chesley, P.W. Chodas, 2010, in: A.M. Finkelstein, W.F. Huebner & V.A. Shor (eds.), <i>Proceedings Intern. Conf. Asteroid-Comet Hazard 2009, Protecting the Earth against collisions with asteroids and comet nuclei</i>, St. Petersburg (Russian Federation), 21-25 September 2009 (Saint Petersburg: Nauka), p. 244, "NASA's Near-Earth Object Program Office."
2010, Jan	T. Kwiakowski, D.A.H. Buckley, D. O'Donoghue, et al., 2010, <i>Astronomy & Astrophysics</i>, 509, A94, "Photometric survey of the very small near-Earth asteroids with the SALT telescope . I. Lightcurves and periods for 14 objects." See: http://adsabs.harvard.edu/abs/2010A%26A...509A..94K
2010, Jan	T. Kwiakowski, 2010, <i>Astronomy & Astrophysics</i>, 509, A95, "Photometric survey of the very small near-Earth asteroids with the SALT telescope. II. Discussion of YORP." See: http://adsabs.harvard.edu/abs/2010A%26A...509A..95K
2010, Jan 4	A. Nathues, H. Boehnhardt, A.W. Harris, et al., 2010, <i>Advances in Space Research</i>, 45, 169, "ASTEX: an in situ exploration mission to two near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2010AdSpR...45..169N
2010, Jan 6	Object P/2010 A2, discovered by LINEAR, is an unusual object that superficially looks like a (Encke-type) comet but lives among the asteroids. HST and Rosetta observations show a bizarre X-pattern of filamentary structures near the point-like nucleus of the object and

	trailing streamers of dust. This complex structure suggests the object is not a comet but instead the product of a head-on collision between two asteroids. See: http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=P%2F2010+A2&orb=1 http://en.wikipedia.org/wiki/P/2010_A2 Ref: - C. Snodgrass, C. Tubania, J.-B. Vincent, et al., 14 October 2010, <i>Nature</i>, 467, 814, "A collision in 2009 as the origin of the debris tail of asteroid P/2010 A2." See: http://adsabs.harvard.edu/abs/2010Natur.467..814S - D. Jewitt, H. Weaver, J. Agarwal, et al., 14 October 2010, <i>Nature</i>, 467, 817, "A recent disruption of the main-belt asteroid P/2010 A2." See: http://adsabs.harvard.edu/abs/2010Natur.467..817J - D. Jewitt, J.S. Stuart, J. Li, 2011, <i>Astronomical Journal</i>, 142, Issue 1, article id. 28, "Pre-discovery observations of disrupting asteroid P/2010 A2." See: http://adsabs.harvard.edu/abs/2011AJ....142...28J - O.R. Hainaut, J. Kleyna, G. Sarid, et al., 2012, <i>Astronomy & Astrophysics</i>, 537, 69, "P/2010 A2 LINEAR. I. An impact in the asteroid main belt." See: http://adsabs.harvard.edu/abs/2012A%26A...537A..69H - D. Jewitt, M. Ishiguro, J. Agarwal, February 2013, <i>Astrophysical Journal</i> (Letters), 764, L5, "Large particles in active asteroid P/2010 A2." See: http://adsabs.harvard.edu/abs/2013ApJ...764L...5J - J. Agarwal, D. Jewitt, H. Weaver, 20 May 2013, <i>Astrophysical Journal</i>, 769, 46, "Dynamics of large fragments in the tail of active asteroid P/2010 A2." See: http://adsabs.harvard.edu/abs/2013ApJ...769...46A See also: http://hubblesite.org/newscenter/archive/releases/2010/34 http://hubblesite.org/newscenter/archive/releases/2010/07/full/ http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=47830 http://www.spacetelescope.org/news/heic1016/ http://hubblesite.org/pubinfo/pdf/2010/34/pdf.pdf http://www.scientificamerican.com/article.cfm?id=comet-may-be-colliding-asteroids-2010-01 http://www.scientificamerican.com/article.cfm?id=comet-tail-asteroid
2010, Jan 10	NASA's Flexible Path evaluation of human mission in 2025 to visit an asteroid. See: http://www.nasaspaceflight.com/2010/01/nasas-flexible-path-2025-human-mission-visit-asteroid/
2010, Jan 12	NASA's Wide-field Infrared Survey Explorer (WISE), spotted its first never-before-seen near-Earth asteroid, 2010 AB78 ($H = 18.6$

	mag, $D \approx 0.6$ km), at a distance of $\sim 160 \times 10^6$ km. See: http://www.nasa.gov/mission_pages/WISE/news/wise20100122.html http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2460 http://www.astro.ucla.edu/~wright/WISE/
2010, Jan 13	Apollo NEA 2010 AL30 ($H = 27.3$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2010-01] Discovered by the LINEAR survey of MIT's Lincoln Laboratories on 10 January 2010. Radar observations with the Goldstone planetary radar had been planned. One would expect a NEA of this size, one of $\sim 2,000,000$ such objects in near-Earth space, to pass Earth within 1 LD about once every week on average. See: 2010 AL30 - SSA , 2010 AL30 - JPL See also: http://neo.jpl.nasa.gov/news/news167.html http://www.wired.com/wiredscience/2010/01/wednesdays-near-earth-asteroid-caught-on-film/ http://en.wikipedia.org/wiki/2010_AL30
2010, Jan 14	Apollo NEA 2015 AQ43 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 3.99 LD. Minimum miss distance 0.04 LD. See: 2015 AQ43 - SSA , 2015 AQ43 - JPL See also: 14 Jan 2015.
2010, Jan 18-20	Workshop on NEO Information, Analysis and Warning, Mexico City (Mexico). Sponsored by the Association of Space Explorers (ASE), the Secure World Foundation (SWF), and the Centro Regional de Enseñanza de Ciencia y Tecnología del Espacio para America Latina y el Caribe (CRECTEALC). Summary: Functions and Characteristics of NEO Information, Analysis and Warning Network (IWAN). See: http://www.space-explorers.org/ http://www.space-explorers.org/committees/NEO/NEO%20IAWN%20Workshop%20Executive%20Summary%202-12-10.pdf http://www.unoosa.org/pdf/pres/stsc2010/tech-24.pdf http://swfound.org/events/2010/neo-information-analysis-and-warning-network-workshop
2010, Jan 20	C.R. Chapman, 2010, <i>Nature</i> (News & Views), 463, 305, "Asteroids: stripped on passing by Earth." See: http://adsabs.harvard.edu/abs/2010Natur.463..305C
2010, Jan 21	R.P. Binzel, A. Morbidelli, S. Merouana, et al., 2010, <i>Nature</i> (Letters), 463, 331, "Earth encounters as the origin of fresh surfaces on near-Earth asteroids."

	See: http://adsabs.harvard.edu/abs/2010Natur.463..331B http://www.scientificamerican.com/article.cfm?id=asteroid-quakes
2010, Jan 22	US National Research Council Space Studies Board Committee (chair Irwin Shapiro) on <i>Defending Planet Earth: Near Earth Object Surveys and Hazard Mitigation Strategies</i>. Final Report. The report calls for an international body that would be prepared to take action and defend the planet whenever an asteroid is discovered on a likely collision course. The body would be composed of <i>"representatives of nations concerned with this problem and willing to invest in preparedness for damaging collisions."</i> If a hazardous asteroid were discovered far enough in advance, that body could arrange for a space mission to deflect it. <i>"It's the only natural disaster we know about where we could actually prevent it."</i> US Congress has set a goal of mapping 90% of NEOs with $D > 140$ m by 2020. The report states that at the current rate of funding the effort will take decades. It also notes that possibly even NEOs as small as 30 – 50 m may pose a serious threat. The most promising search tool being built – the Large Synoptic Survey Telescope – may lose out on funding in current project prioritization. The report gives two options for detection of the $D > 140$ m NEOs – completion by 2020 would require space missions, one in Sun-Earth Lagrangian point L1 and one in a Venus-trailing orbit. While use of a large ground based telescope would be cheaper but reach the goal only by 2030. See: http://www.nap.edu/catalog/12842.html http://www.scientificamerican.com/blog/post.cfm?id=new-report-warns-against-smaller-ne-2010-01-22 http://www.scientificamerican.com/article.cfm?id=asteroid-impact-climate-change http://www.universetoday.com/2010/01/22/asteroid-detection-deflection-needs-more-money-report-says/ http://www.space.com/scienceastronomy/asteroid-hunt-space-telescopes-100204.html
2010, Jan 23	R. Arentz, H. Reitsema, J. Van Cleve, R. Linfield, 2010, in: Proc. <i>Space, Propulsion & Energy Sciences International Forum SPESIF-2010</i>, Baltimore, 23-26 February 2010, AIP Conf. Proc., 1208, 418, "NEO Survey, an efficient search for Near-Earth Objects by an IR observatory in a Venus-like orbit." See: http://adsabs.harvard.edu/abs/2010AIPC.1208..418A Submitted to the Primitive Bodies Subcommittee of the Decadal Survey. A 50 cm telescope with a 2×5 degree FoV, and a camera working at 40 K in the 6 – 10.5 μm range, capable of detecting 85% of all NEOs with $D > 100$ m, 70% of those with $D > 60$ m, and about 50% of those with $D > 50$ m, in a period of 7.5 years. Also presented at 1st IAA Planetary Defense Conference, see 27-30 April 2009.

	See: http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=APCPCS001208000001000418000001&idtype=cvips&gifs=yes&ref=no http://www.lpi.usra.edu/decadal/sbag/topical_wp/RobertFArentz.pdf http://www.space.com/news/nasa-neo-asteroid-spacecraft-101221.html
2010, Jan 23	I. Semeniuk, 2010, <i>Sky & Telescope</i> , 23 January 2010, "Asteroids pale after close encounters." See: http://www.skyandtelescope.com/news/82499022.html
2010, Feb	M. Birlan, O. Vaduvescu, A. Tudorica, et al., 2010, <i>Astronomy & Astrophysics</i> , 511, 40, "More than 160 near Earth asteroids observed in the EURONEAR network." See: http://adsabs.harvard.edu/abs/2010A%26A...511A..40B
2010, Feb	T. Kwiatkowski, M. Polinska, N. Loaring, et al., 2010, <i>Astronomy & Astrophysics</i> , 511, A49, "Photometric survey of the very small near-Earth asteroids with the SALT telescope. III. Lightcurves and periods for 12 objects and negative detections." See: http://adsabs.harvard.edu/abs/2010A%26A...511A..49K
2010, Feb	C.A. Thomas, R.P. Binzel, 2010, <i>Icarus</i> , 205, 419, "Identifying meteorite source regions through near-Earth object spectroscopy." See: http://adsabs.harvard.edu/abs/2010Icar..205..419T
2010, Feb 3	ESA <i>Space News</i> , 3 February 2010, ESA Mars Express , "Craters young and old in Sirenum Fossae." See: http://www.esa.int/esaSC/SEMJLFSJR4G_index_0.html
2010, Feb 8	Aten NEA 2015 CL ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 1.04 LD. Minimum miss distance 1.04 LD. See: 2015 CL - SSA , 2015 CL - JPL
2010, Feb 9	Final Report of the Research Project <i>Legal Aspects of NEO Threat Response and Related Institutional Issues</i> , undertaken by the University of Nebraska-Lincoln's Programme on Space and Telecommunications Law, sponsored by the Secure World Foundation and with the support of an International Advisory Board of eminent international space law experts from various states around the world, members of the International institute of Space Law (IISL) and the International Academy of Astronautics (IAA). Rapporteur: Frans G. von der Dunk. See: http://spaceandtelecomlaw.unl.edu/home/neoresearchproject
2010, Feb 15-16	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Scientific and Technical Subcommittee, 47th Session, Action Team 14 on NEOs , chaired by Sergio Camacho (Mexico),

	meets in Vienna (Austria). Report: http://www.unoosa.org/pdf/reports/ac105/AC105_958E.pdf http://www.unoosa.org/pdf/limited/c1/AC105_C1_L300E.pdf http://www.unoosa.org/pdf/limited/c1/AC105_C1_NEO_2010_L01E.pdf Among the Technical presentations: - ASE, SWF, CRECTEAL, 2010, "NEO IAWN Workshop summary." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-24.pdf - S. Freeland, 2010, "Legal aspects of NEO threat response and related institutional issues." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-25.pdf - B. Shustov, 2010, "The NEO problem: activities in Russia." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-35.pdf - D. Koschny, 2010, "Current status of ESA's Space Situational Awareness Near-Earth Object programme." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-36.pdf - L. Johnson, 2010, "Near Earth Object Observations Program." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-39.pdf - O. Ventskovsky, 2010, "Global project on the anti-asteroid protection of the Earth." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-41.pdf - A.S. Koroteev, B.A. Liaschuk, S.A. Popov, et al., 2010, "On the possible approach to formation of echelon of short-term reaction of the international planetary defense system." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-43.pdf - T. Okada, 2010, "The Hayabusa mission: challenge to Near-Earth Asteroid sample-return and new insights into solar system origin." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-44.pdf - J.-Y. Prado, 2010, "Apophis 2029, a unique mission opportunity." See: http://www.unoosa.org/pdf/pres/stsc2010/tech-45.pdf
2010, Feb 17	Aten NEA 2010 CK19 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2010-02] See: 2010 CK19 - SSA , 2010 CK19 - JPL
2010, Feb 21	Apollo NEA 2010 DJ1 ($H = 27.1$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 1.002 LD. Minimum miss distance 1.002 LD. It passed the Moon at anominal miss distance of 0.48 LD. Minimum miss distance 0.48 LD See: 2010 DJ1 - SSA , 2010 DJ1 - JPL
2010, Feb 23	C.A. Maddock, 2010, <i>On the dynamics, navigation and control of a spacecraft formation of solar concentrators in the proximity of an asteroid</i>, PhD thesis, University of Glasgow (UK).

	See: http://theses.gla.ac.uk/1572/01/2010maddockphd.pdf http://planetarydefense.blogspot.com/2010/03/dr-christie-maddocks-thesis-now.html
2010, Feb 28	Košice meteorite fall. Occurred in eastern Slovakia on February 28, 2010, 22:25 UT. The very bright bolide was imaged by three security video cameras from Hungary. Ref: - J. Borovička, J. Tóth, A. Igaz, 2013, <i>Meteoritics & Planetary Science</i>, 48, 1757, "The Košice meteorite fall: atmospheric trajectory, fragmentation, and orbit." See: http://onlinelibrary.wiley.com/doi/10.1111/maps.12078/
2010, Mar	P.R. Renne, H.P. Schwarcz, M.R. Kleindienst, et al., 2010, <i>Earth and Planetary Science Letters</i>, 291, 201, "Age of the Dakhleh impact event and implications for Middle Stone Age archeology in the western desert of Egypt." See: http://adsabs.harvard.edu/abs/2010E%26PSL.291..201R
2010, Mar 5	P. Schulte, L. Alegret, I. Arenillas, et al., 5 March 2010, <i>Science</i>, 327, 1214, "The Chicxulub asteroid impact and mass extinction at the Cretaceous-Paleogene boundary." See: http://adsabs.harvard.edu/abs/2010Sci...327.1214S See also: http://www.sciencedaily.com/releases/2010/03/100304142242.htm
2010, Mar 11-12	Second Asian Asteroid Observation Network Workshop, Lijiang (Yunnan, China).
2010, Mar 31	R. Lloyd, <i>Scientific American</i>, 31 March 2010, "Competing catastrophes: what's the bigger menace, an asteroid impact or climate change?" See: http://www.scientificamerican.com/article.cfm?id=asteroid-impact-climate-change
2010, Apr	C.R. Chapman, D. Morrison, 2010, in: Proceedings Astrobiology Science Conference 2010: <i>Evolution and Life: Surviving Catastrophes and Extremes on Earth and Beyond</i>, 26-30 April, 2010, League City (TX, USA), LPI Contribution No. 1538, p. 5164, "Planetary defense and near-Earth objects." See: http://adsabs.harvard.edu/abs/2010LPICo1538.5164C http://www.lpi.usra.edu/meetings/abscicon2010/pdf/5164.pdf
2010, Apr	J. de León, H. Campis, K. Tsiganis, et al., 2010, <i>Astronomy and Astrophysics</i>, 513, id.A26, "Origin of the near-Earth asteroid

	Phaethon and the Geminids meteor shower." See: http://adsabs.harvard.edu/abs/2010A%26A...513A..26D
2010, Apr	G.R. Osinski, C.S. Cockell, P. Lindgren, J. Parnell, 2010, in: Proceedings Astrobiology Science Conference 2010, <i>Evolution and Life: Surviving Catastrophes and Extremes on Earth and Beyond</i>, 26-30 April, 2010, League City (TX, USA), LPI Contribution No. 1538, p. 5252, "The effect of meteorite impacts on the elements essential for life." See: http://adsabs.harvard.edu/abs/2010LPICo1538.5252O http://www.lpi.usra.edu/meetings/abscicon2010/pdf/5252.pdf
2010, Apr 1	E. Asphaug, 2010, <i>Chemie der Erde - Geochemistry</i>, 70, 199, "Similar-sized collisions and the diversity of planets." See: http://adsabs.harvard.edu/abs/2010ChEG...70..199A
2010, Apr 9	Apollo NEA 2010 GA6 ($H = 26.2$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 1.13 LD. Minimum miss distance 1.13 LD. See: 2010 GA6 - SSA , 2010 GA6 - JPL See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2549 http://www.scientificamerican.com/blog/post.cfm?id=newfound-asteroid-will-pass-by-eart-2010-04-08 http://en.wikipedia.org/wiki/2010_GA6
2010, Apr 14	Wisconsin Fireball, seen in at least six US states. The parent body was ~ 1 m in diameter and while disintegrating released energy equivalent to the detonation of ~ 20 tons of TNT. See: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2565 See also: http://articles.cnn.com/2010-04-15/tech/midwest.fireball_1_fireball-nws-northern-sky?_s=PM:TECH http://articles.cnn.com/2010-04-26/us/wisconsin.meteorite.boomtown_1_meteorite-space-rock-livingston?_s=PM:US
2010, Apr 15	US President Barack Obama on Space Exploration in the 21st Century, speaking at John F. Kennedy Space Center, Merritt Island (FL, USA): "... And by 2025, we expect new spacecraft designed for long journeys to allow us to begin the first-ever crewed missions beyond the Moon into deep space. So we'll start – we'll start by sending astronauts to an asteroid for the first time in history. By the mid-2030s, I believe we can send humans to orbit Mars and return them safely to Earth. And a landing on Mars will follow. And I expect to be around to see it" This follows recommendations of the

	Augustine Review of 22 Oct 2009. See: http://www.whitehouse.gov/the-press-office/remarks-president-space-exploration-21st-century http://www.nasa.gov/about/obamaspeechfeature.html http://www.nasa.gov/news/media/trans/obama_ksc_trans.html http://www.nasa.gov/pdf/396093main_HSF_Cmte_FinalReport.pdf This is formalized in the document <i>National Space Policy of the United States of America</i> of 28 June 2010. See also: http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf http://www.nytimes.com/2010/04/16/science/space/16nasa.html http://www.usatoday.com/cleanprint/?1289391814765 http://www.space.com/18373-presidential-election-obama-nasa-future.html http://www.space.com/18380-nasa-moon-missions-obama-election.html
2010, Apr 15	Establishment of the NASA Advisory Council Ad Hoc Task Force on Planetary Defense. See: http://www.nasa.gov/pdf/490945main_10-10_TFPD.pdf http://www.nasa.gov/exploration/about/planetarydefense_taskforce_prt.htm http://www.planetary.org/programs/projects/space_information/20101027.html
2010, Apr 18	Apollo NEA 2010 HP20 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.08 LD. [2010-03] See: 2010 HP20 - SSA , 2010 HP20 - JPL
2010, Apr 19	H. Campins, K. Hargrove, N. Pinilla-Alonso, et al., 2010, <i>Nature</i>, 464, 1320, "Water ice and organics on the surface of the asteroid 24 Themis." Main-belt asteroid. See: http://adsabs.harvard.edu/abs/2010Natur.464.1320C http://news.nationalgeographic.com/news/2010/04/100428-asteroid-water-first-ice-frost-themis/
2010, Apr 25	Apollo NEA 2019 VB5 ($H = 31.7$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 1.66 LD. Minimum miss distance 0.91 LD. See: 2019 VB5 – SSA , 2019 VB5 - JPL See also: 9 Nov 2019.
2010, Apr 26	Lori B. Garver, NASA Deputy Administrator, 2010, Address at the Center for Strategic and International Studies, Washington DC (USA). Comments on President Obama's speech of 15 April 2010 at the JFK Space Center, Florida (USA), referring to NEAs as the next target for US human spaceflight. One potential target could be asteroid 1999 AO10 ($H = 23.9$ mag, $D \approx 60$ m), which will pass

	Earth at 10.4 LD on 12 February 2026. It could be reached with a launch in 2025 on a 150 day round trip mission, spending ~2 weeks at the asteroid. See: http://www.nasa.gov/pdf/448579main_CSIS_Garver_20100426a.pdf http://www.nasaspaceflight.com/2010/01/nasas-flexible-path-2025-human-mission-visit-asteroid/ http://www.spacegeneration.org/index.php/eventstopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf
2010, May	A. Glikson, 2010, <i>Icarus</i>, 207, 39, "Archaean asteroid impacts, banded iron formations and MIF-S anomalies: a discussion." See: http://adsabs.harvard.edu/abs/2010Icar..207...39G
2010, May	A.W. Harris, 2010, <i>Bull. American Astron. Soc.</i>, 41, 930, "Cosmic disasters, real and imagined." See: http://adsabs.harvard.edu/abs/2010DDA....41.0601H http://nightsky.jpl.nasa.gov/docs/AlanHarris.ppt
2010, May	O.B. Toon, T. Segura, K. Zahnle, 2010, <i>Annual Review of Earth and Planetary Sciences</i>, 38, 303, "The formation of Martian river valleys by impacts." See: http://httdsabs.harvard.edu/abs/2010AREPS..38..303T
2010, May 13	Panoramic Survey Telescope And Rapid Response System (Pan-STARRS), Maui, HI, USA). The 1.8 m telescope PS1 on Haleakala goes operational and begins its science mission. The 1.4 giga-pixel digital camera will take over 500 exposures each night and send about 4 terabytes of data to the Maui High Performance Computing Center for analysis. In the next three years, PS1 is expected to discover ~100,000 asteroids. PS1 is the experimental proptotype for the larger PS4 telescope, which will have four times the power of PS1 and is planned for Mauna Kea. See item 6 December 2008. See: http://pan-starrs.ifa.hawaii.edu/public/ http://www.ifa.hawaii.edu/info/press-releases/PS1/ http://www.scientificamerican.com/article.cfm?id=pan-starrs-neo http://www.spacedaily.com/reports/PS1_Telescope_Establishes_Near_Earth_Asteroid_Discovery_Record_999.html
2010, May 17	Asteroid 2010 JL88 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 1.002 LD. Minimum miss distance 1.001 LD. It passed the Moon at a nominal miss distance of 0.495 LD. Minimum miss distance 0.494 LD. See: 2010 JL88 - SSA , 2010 JL88 - JPL

	See: also: https://en.wikipedia.org/wiki/2010_JL88 See also: 5 Nov 1963, 15 May 2005, 5 Nov 2020
2010, May 20	Australian National University scientists identified a dome at least 50 km in diameter, buried under the Timor Sea, that was created by a giant asteroid that collided with Earth ~35 million yr ago – a period of heavy extraterrestrial bombardment. Ref: - A.Y. Glikson, D. Jablonski, S. Westlake, 2010, <i>Australian Journal of Earth Sciences</i>, 57, 411, "Origin of the Mt Ashmore structural dome, west Bonaparte Basin, Timor Sea." See: http://www.tandfonline.com/doi/abs/10.1080/08120099.2010.481327?scroll=top&needAccess=true&journalCode=taje20 See also: http://news.anu.edu.au/?p=2159
2010, May 21	J.D. Archibald, W.A. Clemens, K. Padian, et al., <i>Science</i>, 328, 973, "Cretaceous-Extinctions: multiple causes." See: http://www.sciencemag.org/search?site_area=sci&y=9&x=32&fulltext=Cretaceous-Extinctions%3A%20multiple%20causes&submit=yes
2010, May 21	P. Schulte, L. Alegret, I. Arenillas, et al., 2010, <i>Science</i>, 328, 975, "Cretaceous-Extinctions: multiple causes / responses." See: http://www.sciencemag.org/content/328/5981/975.full
2010, May 21	Object 2010 KQ ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.9 LD. Its orbit around the Sun is so similar to the Earth's orbit, that it is suspected to be a rocket stage which escaped years ago from the Earth-Moon system. See: http://www.jpl.nasa.gov/news/news.cfm?release=2010-183 http://neo.jpl.nasa.gov/news/news168.html Ref: - R. Miles, 2011, <i>Journal of the British Astronomical Association</i>, 121, 350, "The unusual case of 'asteroid' 2010 KQ: a newly discovered artificial object orbiting the Sun." See: http://adsabs.harvard.edu/abs/2011JBAA..121..350M See also: http://en.wikipedia.org/wiki/2010_KQ See also: 3 Jan 2036.
2010, May 21-23	<i>Meeting on Asteroids and Comets in Europe</i>, Višnja/Tićan (Croatia).

	See: http://www.minorplanets.org/MACE2010/
2010, May 23	Apollo NEA 2010 KO10 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [2010-04] See: 2010 KO10 - SSA , 2010 KO10 - JPL
2010, May 24-28	<i>Meteoroids 2010. International Conference on Minor Bodies in the Solar System</i> , Breckenridge (CO, USA). See: http://www.space.com/8517-asteroid-probe-return-earth-scientists-edge.html http://www.space.com/8604-nasa-prepares-potentially-damaging-2011-meteor-shower.html http://www.space.com/8986-asteroid-threat-early-warning-system-proposed.html
2010, May 26	Aten NEA 2010 KV39 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2010-05] See: 2010 KV39 - SSA , 2010 KV39 - JPL
2010, May/Jun	D. Morrison, 2010, <i>Skeptical Inquirer</i> , 34.3, "Did a cosmic impact kill the mammoths?" See: http://www.csicop.org/si/show/did_a_cosmic_impact_kill_the_mammoths/
2010, Jun	M. Ćuk, B.J. Gladman, S.T. Stewart, 2010, <i>Icarus</i> , 207, 590, "Constraints on the source of lunar cataclysm impactors." See: http://adsabs.harvard.edu/abs/2010Icar..207..590C Read also: - R. Malhotra, R.G. Strom, 2011, <i>Icarus</i> , 216, 359, "Comment on "Constraints on the source of lunar cataclysm impactors" (Ćuk et al., 2010, <i>Icarus</i> , 207, 590-594)." See: http://adsabs.harvard.edu/abs/2011Icar..216..359M - M. Ćuk, B.J. Gladman, S.T. Stewart, 2011, <i>Icarus</i> , 216, 363, "Rebuttal to the comment by Malhotra and Strom on 'Constraints on the source of lunar cataclysm impactors'." See: http://adsabs.harvard.edu/abs/2011Icar..216..363C
2010, Jun	G. de Villiers, D.T. King, L.J. Marzen, 2010, <i>Meteoritics and Planetary Science</i> , 45, 947, "A study of candidate marine target impact craters in Arabia Terra, Mars ." See: http://adsabs.harvard.edu/abs/2010M%26PS...45..947D
2010, Jun	J. Hopkins, A. Dissel, M. Jones, et al., Lockheed Martin, 2010, " Plymouth Rock . An early human mission to Near Earth

	Asteroids using Orion spacecraft". Version 2.0. See: http://www.lockheedmartin.com/data/assets/ssc/Orion/Toolkit/OrionAsteroidMissionWhitePaperAug2010.pdf
2010, Jun	R. Lloyd, 2010, <i>Scientific American</i>, 302, 25, "Asteroid collision. An extinction-level event is unlikely, but 'airbursts' could flatten a city." See: http://www.scientificamerican.com/article.cfm?id=interactive-12-events
2010, Jun	R. Lloyd, 2010, <i>Scientific American</i>, 302, 48, "What the future holds. Asteroid collision." See: http://www.nature.com/scientificamerican/journal/v302/n6/full/scientificamerican0610-48a.html
2010, Jun	M. Vasile, C.A. Maddock, 2010, <i>Celestial Mechanics and Dynamical Astronomy</i>, 107, 265, "On the deflection of asteroids with mirrors." See: http://adsabs.harvard.edu/abs/2010CeMDA.107..265V See also: http://planetarydefense.blogspot.com/2010/11/paper-on-deflection-of-asteroids-with.html http://www.planetary.org/programs/projects/mirrorbees/ http://www.bbc.com/future/story/20120622-a-laser-fix-for-asteroid-threats
2010, Jun 3	Fireball lights up Jupiter. Impacting asteroid or comet with $D \approx 8$-13 m. Ref: - R. Hueso, A. Wesley, C. Go, et al., 2010, <i>Astrophysical Journal Letters</i>, 721, L129, "First Earth-based detection of a superbolide on Jupiter." See: http://adsabs.harvard.edu/abs/2010ApJ...721L.129H See also: http://www.jpl.nasa.gov/news/news.cfm?release=2010-293&cid=release_2010-293&msource=2010293B&tr=y&auid=6964089
2010, Jun 7-11	International Conference Gaia: at the frontiers of astrometry, 7-11 June 2010, Sèvre (France). Proc: C. Turon, F. Meynadier, F. Arenou (eds.), 2011, Gaia: at the frontiers of astrometry, <i>ESA Publication Series</i>, 45. See: http://adsabs.harvard.edu/abs/2011EAS....45D...3T http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=45565 http://wwwwhip.obspm.fr/gaia2010/IMG/pdf/Abstract_booklet.pdf
2010, Jun 9-18	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS, 53rd session) and Action Team 14 on NEOs, chaired by

	Sergio Camacho (Mexico), meets in Vienna (Austria). See: http://www.oosa.unvienna.org/pdf/gadocs/A_65_20E.pdf
2010, Jun 11	K. Rowan, 2010, <i>Space.com</i>, "5 reasons to care about asteroids". See: http://www.space.com/8590-5-reasons-care-asteroids.html
2010, Jun 13	Return of JAXA spacecraft Hayabusa, landing in Woomera (Australia), after a seven-year journey to bring a sample of Apollo NEA 25143 Itokawa (1998 SF36, $H = 19.2$ mag, $D = 0.535 \times 0.29 \times 0.209$ km, PHA) back to Earth. See also: 19 Nov 2005, 17 Nov 2010. See: http://hayabusa.jaxa.jp/e/index.html http://www.isas.jaxa.jp/e/topics/2010/0705.shtml http://www.isas.jaxa.jp/e/enterp/missions/hayabusa/index.shtml http://www.jpl.nasa.gov/news/news.cfm?release=2010-194&cid=release_2010-194&msource=2010194&tr=y&auid=6468044 http://airborne.seti.org/hayabusa/ http://blogs.nature.com/news/thegreatbeyond/2010/06/japan_celebrates_asteroid_return.html http://www.nature.com/news/2010/290610/full/466016a.html http://www.spacedaily.com/reports/The_Hayabusa_Adventure_999.html http://news.nationalgeographic.com/news/2010/06/100614-science-space-asteroids-hayabusa-return-fiery/ http://www.youtube.com/watch?v=ljd989jfuis&feature=player_embedded http://www.youtube.com/watch?v=bbI78CZWP7g http://www.youtube.com/watch?v=jEyQDwAUfRQ&NR=1 http://www.youtube.com/watch?v=qtwTD8cBhKc&NR=1 http://www.space.com/news/japan-hayabusa-asteroid-graphic-100611.html http://www.lpi.usra.edu/sbag/meetings/jan2011/presentations/day3/d3_1330_Zolensky_Hayabusa.pdf http://www.oosa.unvienna.org/pdf/reports/ac105/C1/AC105_C1_100E.pdf http://www.space.com/14691-asteroid-impacts-hayabusa-meteorite-samples.html http://www.space.com/14767-lego-asteroid-spacecraft-hayabusa.html http://www.nature.com/news/2011/110825/full/news.2011.506.html http://en.wikipedia.org/wiki/Hayabusa
2010, Jun 23	Asteroid-aware lawmaker U.S. Representative Dana Rohrabacher (R - CA) introduced a bill that would create a special government commission to study the threat of major collisions of asteroids –Near Earth Objects – with the Earth. Rep. Rohrabacher's bill "To establish a United States Commission on Planetary Defense" (H.R. 5587), would create within the legislative branch a United States Commission on Planetary Defense. See: http://usgovinfo.about.com/b/2010/07/26/bill-would-create-asteroid-threat-commission.htm

2010, Jun 25-27	International Workshop Nördlingen 2010: the Ries Crater, the Moon, and the future of human space exploration , Nördlingen (Germany), 25-27 June 2010. See: http://www.lpi.usra.edu/meetings/nordlingen2010/
2010, Jun 25	D. Stöffler, W.U. Reimold, 2010, in: International Workshop <i>Nördlingen 2010: the Ries Crater, the Moon, and the future of human space exploration</i> , Nördlingen (Germany), 25-27 June 2010, LPI Contribution No. 1559, p.37, "The impact of Ries Crater research on the recognition and classification of impact-metamorphosed planetary rocks." See: http://adsabs.harvard.edu/abs/2010LPICo1559...37S
2010, Jul	M. Brozovic, L.A.M. Benner, C. Magri, S.J. Ostro, et al., 2010, <i>Icarus</i> , 208, 207, "Radar observations and a physical model of contact binary asteroid 4486 Mithra ." Apollo NEA, 4486 Mithra , 1987 SB , $H = 15.8$ mag, $D \approx 2.35 \times 1.65 \times 1.44$ km, PHA . See: http://adsabs.harvard.edu/abs/2010Icar..208..207B
2010, Jul	J. de León, J. Licandro, M. Serra-Ricard, et al., 2010, <i>Astronomy & Astrophysics</i> , 517, 23, "Observations, compositional, and physical characterization of near- Earth and Mars -crosser asteroids from a spectroscopic survey." See: http://adsabs.harvard.edu/abs/2010A%26A...517A..23D
2010, Jul	B.D. Warner, P. Pravec, A. Harris, et al. 2010, <i>Minor Planet Bulletin</i> , 37, 86, "Analysis of the lightcurve of (217807) 2000 XK44 : a tumbling [Amor] NEA." See: http://adsabs.harvard.edu/abs/2010MPBu...37...86W
2010, Jul 2	A. Steele, F.M. McCubbin, M. Fries, et al., 2010, <i>Science</i> , 329, 51, "Graphite in an Apollo 17 impact melt breccia." See: http://www.sciencemag.org/content/329/5987/51.short See also: http://www.jpl.nasa.gov/news/news.cfm?release=2010-220&cid=release_2010-220&msource=m20100701&tr=y&auid=6573935
2010, Jul 5-9	2nd International Symposium Space & Global Security of Humanity , Riga (Latvia), 5-9 July 2010. See: http://www.tsi.lv/?id=5108&lang=en&top=336&top=136 http://www.tsi.lv/Research/Conference/SGS-2010/SGS_2010_abstracts.pdf
2010, Jul 5	V.V. Adushkin, A.V. Vityazev, D.V. Gorobets, et al., 2010, presented at the 2nd International Symposium <i>Space & Global Security of Humanity</i> , Riga (Latvia), 5-9 July 2010, "Conceptual, technological and legal bases of creation of the International

	Planetary Defense System (PDS 'Citadel')." See: http://www.tsi.lv/space/SGS1020_221%20-%202005.07.10/Adushkin/IAA-RACT%20C2%20S3-03.pdf
2010, Jul 8-9	NASA Advisory Council's ad-hoc Task Force on Planetary Defense, co-chaired by former astronauts Russell Schweickart and Tom Jones, meeting in Boulder (CO, USA), asked for a Planetary Defense Coordination Office. See: http://www.nasa.gov/directorates/heo/library/nac/planetary-defense.html Presentations: - L. Johnson, 2010, "NASA Near Earth Object (NEO) program status; NASA FY11 budget for NEO Research." See: http://www.nasa.gov/pdf/467238main_20100415_NEOObservationsProgram_Johnson.pdf - E. Crawley, 2010, "NEOs in the context of the Augustine Committee report (Oct 09)." See: http://www.nasa.gov/pdf/466631main_20100416Synopsis_ReviewOfHumanSpaceflightCommittee_Crawley.pdf See also: http://www.nature.com/news/2010/100908/full/467140a.html http://www.space.com/news/nasa-asteroid-impact-near-earth-objects-planetary-defense-100726.html
2010, Jul 10	ESA spacecraft Rosetta fly-by of Main-belt asteroid 21 Lutetia ($H = 7.5$ mag, $D = 132 \times 101 \times 76$ km), at a distance of 3162 km. See: 21 Lutetia - SSA , 21 Lutetia - JPL Ref: - S.A. Stern, J.Wm. Parker, P.D. Feldman, et al., 2011, <i>Astronomical Journal</i>, 141(6), article id. 199, "Ultraviolet discoveries at asteroid (21) Lutetia by the Rosetta Alice Ultraviolet Spectrograph." See: http://adsabs.harvard.edu/abs/2011AJ....141..199S - H. Sierks, P. Lamy, C. Barbieri, et al., 2011, <i>Science</i>, 334, 487, "Images of asteroid 21 Lutetia: a remnant planetesimal from the early Solar System." See: http://adsabs.harvard.edu/abs/2011Sci...334..487S - P. Vemazza, P. Lamy, O. Groussin, et al., 2011, <i>Icarus</i>, 216, 650, "Asteroid (21) Lutetia as a remnant of Earth's precursor planetesimals." See: http://adsabs.harvard.edu/abs/2011Icar..216..650V - R. Schulz, H. Sierks, M. Küppers, A. Accomazzo, 2012, <i>Planetary and Space Science</i>, 66, 2, "Rosetta fly-by at asteroid (21) Lutetia: an overview." See: http://adsabs.harvard.edu/abs/2012P%26SS...66....2S See also: http://www.esa.int/SPECIALS/Rosetta/index.html

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2010, Jul 16	NASA spacecraft WISE completed its first half-year of observations, its program NEO-WISE detecting at infrared wavelengths 97 new near-Earth asteroids, including 14 PHAs. A 10 August report said that the spacecraft is running out of the frozen coolant needed to keep its heat-sensitive instrument chilled. See: http://wise.ssl.berkeley.edu/ http://neo.jpl.nasa.gov/stats/wise/ http://www.jpl.nasa.gov/news/news.cfm?release=2010-238
2010, Jul 18-25	38th COSPAR Scientific Assembly, Bremen (Germany), session B04, <i>Small body exploration: past, present and future space missions</i>. See: http://www.cospar-assembly.org/
2010, Jul 19	EU Call for Proposals Work Programme 2011, Cooperation Theme 9 <i>Space</i> (European Commission C(2010)4900 of 19 July 2010), Activity 9.2: Strengthening the foundations of space science and technology, Area 9.2.3: Research into reducing the vulnerability of space assets, SPA.2011.2.3-01: Prevention of impacts from Near Earth Objects (NEOs) on our Planet. Deadline: 25 November 2010. See: http://www.eurosfaire.prd.fr/7pc/documents/1279796061_paris_info_day30june10_ce.ppt#258,1,Slide_1 http://www.euresearch.ch/fileadmin/documents/events2010/2010_InfoDay-Space_MaT.pdf
2010, Jul 26-30	73rd Annual Meeting of the Meteoritical Society, New York (NY, USA) 26-30 July 2011. See: http://www.lpi.usra.edu/meetings/metsoc2010/
2010, Jul 28	N. Kaiser, W. Burgett, K.C. Chambers, et al., 2010, in: L.M. Stepp, R. Gilmozzi & H.J. Hall (eds.), Ground-based and airborne telescopes. III, <i>Proceedings of the SPIE</i>, 7733, 77330E, "The Pan-STARRS wide-field optical/NIR imaging survey." See: http://adsabs.harvard.edu/abs/2010SPIE.7733E..12K

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2010, July-August	G. Meishan Goh, 2010, <i>Acta Astronautica</i>, 67, 230, "Pella vilya: Near Earth Objects—Planetary defence through the regulation of resource utilisation." See: http://adsabs.harvard.edu/abs/2010AcAau..67..230M
2010, Aug 3-4	Third NASA Small Bodies Assessment Group Meeting, Pasadena (CA, USA). See: http://www.lpi.usra.edu/sbag/meetings/ http://www.lpi.usra.edu/sbag/meetings/aug2010/agenda.shtml Findings: https://www.lpi.usra.edu/sbag/findings/ Among the papers: - P. Abell, R. Landis, 2010, "New NASA initiatives for the exploration of Near-Earth Objects." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/Abell_Human_NEO_Mission_3rd%20SBAG2010.pdf - P. Abell, 2010, "Human exploration." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/Human_Exploration_Outline.pdf - M. Zolensky, 2010, "<i>Hayabusa</i> mission update." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/HayabusaRecoveryMZolensky.pdf - B. Geldzahler, J. Crusan, P. Martin, et al., 2010, "NEO tracking and characterization facility." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/Geldzahler_NEO_Tracking_and_Characterization_Facility_v5.pdf - J. Nuth, 2010, "Small body science issues." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/NuthSmallBodyScienceIssues.pdf - Y. Fernandez, 2010, "Outline: population identification and characterization." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/fernandez_outline-ident.pdf - D. Britt, 2010, "Small Bodies roadmap outline: in-situ study." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/britt_outline_insitu.pdf - P. Weissman, 2010, "SBAG roadmap: sample return." See: http://www.lpi.usra.edu/sbag/meetings/aug2010/presentations/weissman_Sa

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2010, Aug 10-11	NASA Interactive Workshop Exploration of Near Earth Object objectives, to identify objectives for exploration missions to near-Earth objects. Washington DC (USA). See: http://www.nasa.gov/home/hqnews/2010/aug/HQ_M10-105_NEO_Workshop.html http://www.nasa.gov/exploration/new_space_enterprise/home/neoworkshop.html
2010, Aug 13	L. Folco, M. di Martino, A. El Barkooky, 2010, <i>Science</i>, 329, 804, "The Kamil Crater in Egypt." A newly discovered impact crater. See: http://www.sciencemag.org/content/329/5993/804.abstract
2010, Aug 20	Fireball lights up Jupiter. Impacting asteroid or comet. See: http://www.jpl.nasa.gov/news/news.cfm?release=2010-293&cid=release_2010-293&msource=2010293B&tr=y&auid=6964089
2010, Aug 26	Announcement of the winner of the Space Generation Advisory Council International Student and Young Professional Technical Paper Competition <i>Asteroid Warning System 2010</i>: Ben Corbin (MIT, USA), 2010, presented at the <i>61st International Astronautical Congress</i>, Prague (Czech Republic), 27 September - 1 October 2010, "Implementing advanced technologies and models to reduce uncertainty in a global, cost-effective asteroid mitigation system". See: http://spacegeneration.org/index.php/eventsttopics/news/169-win-a-trip-to-sgc-and-iac-with-the-2010-move-an-asteroid-competition http://today.ucf.edu/ucf-alum-writes-asteroid-warning-strategy/ http://www.spacegeneration.org/index.php/eventsttopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf http://www.gbv.de/dms/tib-ub-hannover/66102427x.pdf
2010, Aug 30	Plymouth Rock deep space asteroid mission presented. See: http://www.space.com/news/asteroid-mission-plans-orion-spacecraft-100830.html
2010, Aug 31	K. Beatty, <i>Sky & Telescope</i>, 31 August 2010, "The dinosaurs got a warning shot." See: http://www.skyandtelescope.com/community/skyblog/newsblog/101880488.html
2010, Sep	P.A. Bland, P. Spurný, L. Shrbený, et al., 2010, <i>73rd Annual Meeting of the Meteoritical Society</i>, New York (NY, USA), 26-30 July 2010, <i>Meteoritics and Planetary Science Supplement</i>, id. id.5209,

	"Meteorite falls observed by the Desert Fireball Network: an update." See: http://adsabs.harvard.edu/abs/2010M%26PSA..73.5209B
2010, Sep	H. Campins, A. Morbidelli, K. Tsiganis, et al., 2010, <i>Astrophysical Journal</i> (Letters), 721, L53, "The origin of asteroid 101955 (1999 RQ36)." See: http://adsabs.harvard.edu/abs/2010ApJ...721L..53C
2010, Sep	T.J. Goldin, C. Koeberl, H.J. Melosh, 2010, <i>73rd Annual Meeting of the Meteoritical Society</i>, New York (NY, USA), 26-30 July 2010, <i>Meteoritics and Planetary Science Supplement</i>, id. id.5261, "The fate of ejecta rays in the Earth's atmosphere: from Popigai to Chicxulub." See: http://adsabs.harvard.edu/abs/2010M%26PSA..73.5261G
2010, Sep	T. Ito, R. Malhotra, 2010, <i>Astronomy & Astrophysics</i>, 519, A63, "Asymmetric impacts of near-Earth asteroids on the Moon." See: http://adsabs.harvard.edu/abs/2010A%26A...519A..63I
2010, Sep	G.L. Matloff, L. Leng, T. Le, 2010, in: <i>73rd Annual Meeting of the Meteoritical Society</i>, New York (NY, USA), July 26-30 2010, <i>Meteoritics and Planetary Science Supplement</i>, id.5004, "Optical transmission of an Allende Meteorite thin section and simulated regolith." See: http://adsabs.harvard.edu/abs/2010M%26PSA..73.5004M See also: http://www.sify.com/news/study-sheds-light-on-asteroid-deflection-strategy-to-avert-collision-news-scitech-lb3u4cgibej.html
2010, Sep	E.R.D. Scott, J.I. Goldstein, J. Yang, et al., 2010, in: <i>73rd Annual Meeting of the Meteoritical Society</i>, New York (NY, USA), July 26-30 2010, <i>Meteoritics and Planetary Science Supplement</i>, id.5015, "Iron and stony-iron meteorites and the missing mantle meteorites and asteroids." See: http://adsabs.harvard.edu/abs/2010M%26PSA..73.5015S
2010, Sep	R.P. Binzel, A. Morbidelli, S. Merouane, et al., 2010, in: <i>73rd Annual Meeting of the Meteoritical Society</i>, New York (NY, USA), July 26-30 2010, <i>Meteoritics and Planetary Science Supplement</i>, id.5263, "Asteroid analogs to ordinary chondrite meteorites: Earth encounters as the key to resolving the paradox." See: http://adsabs.harvard.edu/abs/2010M%26PSA..73.5263B
2010, Sep	D. Jolley, I. Gilmour, E. Gurov, 2010, <i>Geology</i>, 38, 835, "Two large meteorite impacts at the Cretaceous-Paleogene boundary." See: http://geology.geoscienceworld.org/cgi/content/abstract/38/9/835 http://www.bbc.co.uk/news/science-environment-11112417?print=true

	http://www.skyandtelescope.com/news/3306656.html?page=1&c=y http://en.wikipedia.org/wiki/Boltysh_crater
2010, Sep	D.E. Trilling, M. Mueller, J.L. Hora, et al., 2010, <i>Astronomical Journal</i>, 140, 770, "ExploreNEOs. I. Description and first results from the Warm-Spitzer Near-Earth Object survey." The Warm Spitzer NEO Survey, exploring the history of the inner Solar System and near Earth space in the two Warm Spitzer wavelength channels at 3.5 μm and 4.5 μm. See: http://adsabs.harvard.edu/abs/2010AJ....140..770T See also: http://www.jpl.nasa.gov/news/news.cfm?release=2010-283 http://www.scientificamerican.com/blog/post.cfm?id=nearby-asteroids-are-a-diverse-bunc-2010-09-03 https://www.jpl.nasa.gov/news/news.php?feature=7575
2010, Sep 3	As a sequel of NEAR, a joint mission study by Johns Hopkins University Applied Physics Laboratory and NASA's Goddard and Johnson Space Flight Centers focuses on Next Gen NEAR, a concept of a robotic precursor for a human visit to a near-Earth asteroid. The mission could launch as soon as 2014 and begin to return data from a target asteroid the following year. See: http://www.jhuapl.edu/newscenter/pressreleases/2010/100903.asp
2010, Sep 8, 09:51	Aten NEA 2010 RX30 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of a nominal miss distance of 0.64 LD. [2010-06] Minimum miss distance 0.64 LD. See: 2010 RX30 - SSA , 2010 RX30 - JPL See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2725 http://neo.jpl.nasa.gov/news/news169.html http://www.astronomynow.com/news/n1009/07asteroids/ http://www.space.com/spacewatch/asteroids-passing-near-earth-telescopes-100908.html http://en.wikipedia.org/wiki/2010_RX30 See also: 8 Sep 1931.
2010, Sep 8, 21:13	Asteroid 2010 RF12 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.207 LD. Minimum miss distance 0.206 LD. [2010-07] See: 2010 RF12 - SSA , 2010 RF12 - JPL See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2725 http://neo.jpl.nasa.gov/news/news169.html http://www.astronomynow.com/news/n1009/07asteroids/ http://www.space.com/spacewatch/asteroids-passing-near-earth-telescopes-100908.html http://en.wikipedia.org/wiki/2010_RF12

	See also: 10 Sep 1915 , 6 Sep 2095 .
2010, Sep 8, 23:58	Apollo NEA 2010 RK53 ($H = 27.9$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2010-08] See: 2010 RK53 - SSA , 2010 RK53 - JPL
2010, Sep 16-19	<i>International Meteor Conference 2010</i> , Armagh (Northern Ireland, UK). See: http://www.imo.net/imc2010 http://www.imo.net/imc2010/schedule.php
2010, Sep 17	J.W. Head III, C.I. Fassett, S.J. Kadish, et al., 2010, <i>Science</i> , 329, 1504, "Global distribution of large lunar craters: implications for resurfacing and impactor populations." See: http://adsabs.harvard.edu/abs/2010Sci...329.1504H http://news.brown.edu/pressreleases/2010/09/moon
2010, Sep 19-24	<i>European Planetary Science Conference (EPSC 2010)</i> , Rome (Italy). See: http://meetings.copernicus.org/epsc2010/ Among the papers: - D.V. Koschny, G. Drolshagen, N. Bobrinsky, M. Gritsevich, 2010, "The European Space Situational Awareness programme ." See: http://adsabs.harvard.edu/abs/2010epsc.conf..686K http://meetings.copernicus.org/epsc2010 p.686. - E. Perozzi, R.P. Binzel, A. Rossi, G.B. Valsecchi, 2010, "Asteroids more accessible than the Moon ." See: http://adsabs.harvard.edu/abs/2010epsc.conf..750P http://meetings.copernicus.org/epsc2010 p.750. - T.J. Jopek, G.B. Valsecchi, 2010, "From meteor observations to meteoroid orbits: propagation of uncertainties." See: http://adsabs.harvard.edu/abs/2010epsc.conf..888J http://meetings.copernicus.org/epsc2010 p.888
2010, Sep 27 – Oct	<i>61st International Astronautical Congress</i> , Prague (Czech Republic). See: http://www.iac2010.cz/en/welcome
2010, Sep 27	R. Williamson, B. Weeden, S. Camacho, T. Jones, R. Schweickart, 2010, IAC-E.3.1.B4, paper presented at <i>23rd Symposium on Space policy, Regulations and Economics</i> , International Astronautical Congress, Prague, 27 September - 1 October 2010, "Responding to

	the threat of potentially-hazardous Near Earth Objects". See: http://swfound.org/media/16114/iac-10.e3.1b.4.pdf
2010, Sep 30	Apollo NEA 2010 SK13 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.69 LD. Minimum miss distance 0.69 LD. [2010-09] See: 2010 SK13 - SSA , 2010 SK13 - JPL
2010, Oct	G. Drolshagen, D. Koschny, N. Bobrinsky, 2010, <i>Cosmic Research</i> , 48(5), 399, "The near-Earth objects segment of the European Space Situational Awareness program." See: http://adsabs.harvard.edu/abs/2010CosRe..48..399D
2010, Oct	D.P. Glavin, A.D. Aubrey, M.P. Callahan, et al., 2010, <i>Meteoritics & Planetary Science</i> , 45, 1695, "Extraterrestrial amino acids in the Almahata Sitta meteorite ." See: http://adsabs.harvard.edu/abs/2010M%26PS...45.1695G
2010, Oct	R. Hueso, A. Wesley, C. Go, 2010, <i>Astrophysical Journal</i> (Letters), 721, L129, "First Earth-based detection of a superbolide on Jupiter." See: http://adsabs.harvard.edu/abs/2010ApJ...721L.129H
2010, Oct	D.C. Hyland, H.A. Altwaijry, S. Ge, et al., 2010, <i>Cosmic Research</i> , 48, 430, "A permanently-acting NEA damage mitigation technique via the Yarkovsky effect." See: http://adsabs.harvard.edu/abs/2010CosRe..48..430H
2010, Oct	D.C. Hyland, H.A. Altwaijry, R. Margulieux, et al., 2010, <i>Cosmic Research</i> , 48, 437, "A mission template for exploration and damage mitigation of potential hazard of Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2010CosRe..48..437H
2010, Oct	J. McMahon, D. Scheeres, 2010, <i>Icarus</i> , 209, 494, "Detailed prediction for the BYORP effect on binary near-Earth Asteroid (66391) 1999 KW4 and implications for the binary population." See: http://adsabs.harvard.edu/abs/2010Icar..209..494M
2010, Oct	P. Michel, M. Delbò, 2010, <i>Icarus</i> , 209, 520, "Orbital and thermal evolutions of four potential targets for a sample return space mission to a primitive near-Earth asteroid." See: http://adsabs.harvard.edu/abs/2010Icar..209..520M
2010, Oct	S.A. Naroenkov, 2010, <i>Cosmic Research</i> , 48, 455, "Storing and processing astrometric and photometric data on NEA: current state and future in Russia." See: http://adsabs.harvard.edu/abs/2010CosRe..48..455N

2010, Oct	D. Nesvorný, W.F. Bottke, D. Vokrouhlický, et al., 2010, <i>Icarus</i> , 209, 510, "Do planetary encounters reset surfaces of near Earth asteroids?" See: http://adsabs.harvard.edu/abs/2010Icar..209..510N
2010, Oct	B.M. Shustov, 2010, <i>Cosmic Research</i> , 48(5), 378, "On coordinated approach to the problem of asteroid-comet impact hazard." See: http://adsabs.harvard.edu/abs/2010CosRe..48..378S
2010, Oct	G.B. Valsecchi, A. Rossi, A. Milani, S.R. Chesley, 2010, in: <i>Mathematics and Astronomy: A Joint Long Journey</i> , AIP Conf. Proc., 1283, 231, "Collision probability: a new analytical derivation." See: http://adsabs.harvard.edu/abs/2010AIPC.1283..231V
2010, Oct 4	NASA spacecraft WISE has reached the expected end of its on-board supply of frozen coolant. Although WISE has 'warmed up,' NASA has decided the mission will still continue. WISE will now focus on asteroids and comets. To date, WISE has discovered 19 comets and more than 33,500 asteroids, including 120 NEOs. The continuation mission, dubbed the NEO-WISE Post-Cryogenic Mission , observes at about –203 C, using only its two shortest-wavelength detectors. See: http://wise.ssl.berkeley.edu/ http://wise.ssl.berkeley.edu/gallery_AsteroidCensus.html http://www.jpl.nasa.gov/news/news.cfm?release=2010-320&cid=release_2010-320&msource=2010320&tr=y&auid=7105499 http://www.space.com/10735-asteroid-survey-space-rocks-comets.html
2010, Oct 5	The Asteroid Terrestrial-impact Last Alert System (ATLAS) project. Update of web site describing proposal 10-NEOO10-0009 to the NASA Near-Earth Object Observation (NEOO) program. ATLAS is meant as a survey complementary to Pan-STARRS , focussing on 140 m – 50 m objects, observing down to $v = 20$ mag with an array of 10-inch telescopes and CCD cameras. This will probably not provide enough warning time to deflect the asteroid – it is intended to provide warning of impending asteroid. Proposers: John Tonry (Univ. of Hawaii, HI, USA), Robert Jedicke (Univ. of Hawaii, HI, USA) and Armin Rest (Space Telescope Science Institute (Baltimore, MD, USA). As of January 2013, the ATLAS program is funded by NASA. See: https://fallingstar.com/home.php http://www.fallingstar.com/index.php http://www.fallingstar.com/ua20111230.php http://www.fallingstar.com/ua20120330.php http://www.fallingstar.com/ua20120630.php

	http://www.fallingstar.com/ua20120930.php Ref: - J.L. Tonry, 2011, <i>Publ. Astron. Soc. Pacific</i>, 123, 58, "An early warning system for asteroid impact." See: http://adsabs.harvard.edu/abs/2011PASP..123...58T - R. Jedicke, J. Tonry, P. Veres, et al., October 2012, American Astronomical Society, DPS meeting #44, #210.12, "ATLAS: Asteroid Terrestrial-impact Last Alert System." See: http://adsabs.harvard.edu/abs/2012DPS....4421012J See also: http://fallingstar.com/index.html http://www.space.com/news/nasa-asteroid-impact-near-earth-objects-planetary-defense-100726.html http://www.msnbc.msn.com/id/38791514/ http://www.ifa.hawaii.edu/info/press-releases/ATLAS/
2010, Oct 6	Report of the NASA Advisory Council Ad Hoc Task Force on Planetary Defense, established 15 April 2010. Members: R.P. Binzel, MIT; C.R. Chapman, SRI, L.N. Johnson, NASA NEOOP; T.D. Jones, IHMC; R.L. Schweickart, B612; B. Wilcox, JPL; D.K. Yeomans, JPL; B. Siegel, NASA ESMD. Recommendations: (1) Organize for effective action on planetary defense; (2) Acquire essential search, track and warning capabilities; (3) Investigate the nature of the impact threat; (4) Prepare to respond to impact threats; (5) Lead U.S. planetary defense efforts in national and international forums. The Task Force called for the creation of a Planetary Defense Coordination Office. See: http://www.nasa.gov/pdf/490945main_10-10_TFPD.pdf http://www.nasa.gov/exploration/about/planetarydefense_taskforce_prt.htm http://www.nasa.gov/pdf/493115main_10-10_TFPD_BRIEFING.pdf See also: http://www.nature.com/news/2010/100908/full/467140a.html http://www.scientificamerican.com/article.cfm?id=nasa-panel-weighs-asteroid-danger http://www.planetary.org/programs/projects/space_information/20101027.html http://www.space.com/news/nasa-planetary-defense-fights-asteroids-101019.html http://gaiashield.com/NACTaskForceFR/NACTaskForceFR.pdf
2010, Oct 9	Apollo NEA 2010 TW54 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2010-10] See: 2010 TW54 - SSA , 2010 TW54 - JPL See also: 10 Oct 2103.
2010, Oct 11	Apollo NEA 2010 TN55 ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a

	nominal miss distance of 0.85 LD. Minimum miss distance 0.85 LD [2010-11] See: 2010 TN55 - SSA , 2010 TN55 - JPL
2010, Oct 12	Apollo NEA 2010 TD54 ($H = 28.6$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.13 LD. [2010-12] A ~5-m sized NEA from the undiscovered population of ~30 million would be expected to pass daily within a lunar distance, and one might strike Earth's atmosphere about every 2 years on average. If an asteroid of the size of 2010 TD54 were to enter Earth's atmosphere, it would be expected to burn up high in the atmosphere and cause no damage to Earth's surface. See: 2010 TD54 - SSA , 2010 TD54 - JPL See also: http://www.jpl.nasa.gov/news/news.cfm?release=2010-332 http://www.space.com/scienceastronomy/small-asteroid-passing-earth-tuesday-101011.html http://www.space.com/spacewatch/small-asteroid--passing-earth-101116.html http://en.wikipedia.org/wiki/2010_TD54
2010, Oct 14	C. Snodgrass, C. Tubiana, J.-B. Vincent, et al., 2010, <i>Nature</i>, 467, 814, "A collision in 2009 as the origin of the debris trail of asteroid P/2010 A2." See: http://adsabs.harvard.edu/abs/2010Natur.467..814S
2010, Oct 15	Memo from John P. Holdren, Director of the White House Office of Science and Technology Policy of the Executive Office of the U.S. President, to U.S. House of Representatives Committee on Science and Technology, and to U.S. Senate Committee on Commerce, Science and Transportation, Washington DC (USA), describing (1) U.S. current and prospective NEO detection activities; (2) notification procedures for a potential NEO threat; (3) emergency response procedures for a potential NEO threat; and (4) U.S. Government roles and responsibilities for potential future NEO mitigation/deflection activities. See: http://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp-letter-neos-house.pdf http://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp-letter-neo-senate.pdf http://www.nature.com/news/2010/101021/full/news.2010.554.html http://www.scientificamerican.com/article.cfm?id=nasa-to-lead-global-asteroid-r http://www.planetary.org/programs/projects/space_information/20101027.html http://www.space.com/news/white-house-plans-asteroid-impact-101021.html

	http://www.space.com/9370-ready-meet-asteroid-threat-white-house-science-adviser.html http://newsfeed.time.com/2010/10/26/white-house-nasa-needs-to-figure-out-how-to-save-us-from-an-asteroid/ http://www.aolnews.com/2010/10/25/hold-for-buck-us-must-be-ready-for-asteroid-strike-top-scienc/ http://gaiashield.com/OSTPNEO/WWOSTPPOTUS.pdf http://gaiashield.com/OSTPNEO/WWOSTPCongress.pdf
2010, Oct 16	Asteroid 2010 UE ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.30 LD. Minimum miss distance 0.29 LD. [2010-13] See: 2010 UE - SSA , 2010 UE - JPL
2010, Oct 17	Aten NEA 2010 TE55 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.95 LD. Minimum miss distance 0.95 LD. [2010-14] See: 2010 TE55 - SSA , 2010 TE55 - JPL
2010, Oct 25	R. Schweickart, 2010, <i>The New York Times</i> , October 25, "Humans to Asteroids: Watch Out!" See: http://www.nytimes.com/2010/10/26/opinion/26schweickart.html?_r=1&scp=1&sq=humans%20to%20asteroids:%20watch%20out!&st=cse
2010, Oct 26	Aten NEA 2010 UY7 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.63 LD. Minimum miss distance 0.63 LD. [2010-15] See: 2010 UY7 - SSA , 2010 UY7 - JPL
2010, Oct 27-29	ESA Mission Planning and Operations Group (MPOG) Workshop Plausible asteroid impact and timing scenarios , 27-29 October 2010, Darmstadt (Germany), co-sponsored by the Association of Space Explorers and the Secure World Foundation . In a post-workshop hand-out, the attendees concluded that: (a) a Mission Planning and Operations Group should be established; (b) the MPOG should identify to space agencies the technical issues involved in planetary defense, to take advantage of synergies between human exploration, science, and study of the NEO hazard; (c) the MPOG should propose research themes in NEO deflection for use by space agencies, addressing those areas most critical for effective deflection strategies; and (d) there is great value in finding hazardous NEOs early, to reduce the costs of deflection missions. Early detection would require upgraded NEO search and tracking capabilities. See: http://www.space-explorers.org/committees/NEO/MPOG.pdf

	http://swfound.org/events/2010/neo-mission-planning-and-operations-group-workshop http://swfound.org/media/16096/mpog%20exec%20summary%2011-18-10a.pdf http://www.esa.int/SPECIALS/ESOC/SEMECCHMI8G_0.html http://www.livestream.com/eurospaceagency/video?clipId=pla_853975ca-049b-4a49-bece-460bf456d05 http://www.space-explorers.org/committees/NEO/MPOG.pdf http://www.mail-archive.com/meteorite-list@meteoritecentral.com/msg91343.html http://www.newswise.com/articles/view/570456/?sc=dwtr&xy=5028369 http://www.spaceguarduk.com/news/312-global-action http://www.bbc.co.uk/blogs/thereporters/jonathanamos/2010/10/when-the-time-comes-to-duck.shtml http://www.space.com/news/asteroid-threat-global-action-plan-101109.html
2010, Oct 27	R. Schweickart, 2010, presented at ESA Mission Planning and Operations Group (MPOG) workshop <i>Plausible asteroid impact and timing scenarios</i>, 27-29 October 2010, Darmstadt (Germany), "Implementation of the MPOG (Mission Planning and Operations Group)". See: http://swfound.org/media/30999/Schweickart%20-%20Intro%20to%20the%20MPOG.pdf
2010, Oct/Nov	Special Issue <i>Meteoritics & Planetary Science</i>, 2010, 45, Issue 10-11, pp. 1553-1845, "2008 TC3 and Almahata Sitta." Dedicated to NEA 2008 TC3, impact on 6 October 2008. Editorial: P. Jenniskens, M.H. Shaddad, 2010, <i>Meteoritics & Planetary Science</i>, 45, 1553, "2008 TC3: the small asteroid with an impact." See: http://adsabs.harvard.edu/abs/2010M%26PS...45.1553J See also: http://onlinelibrary.wiley.com/doi/10.1111/maps.2010.45.issue-10-11/issuetoc http://www.nasa.gov/home/hqnews/2010/dec/HQ_10-340_Asteroid_Meteorite.html
2010, Nov	S.R. Chesley, J. Baer, D.G. Monet, 2010, <i>Icarus</i>, 210, 158, "Treatment of star catalog biases in asteroid astrometric observations." See: http://adsabs.harvard.edu/abs/2010Icar..210..158C The authors illustrate the benefits of debiasing to high-precision astrometric applications such as asteroid mass determination and collision analysis, including a refined prediction of the impact probability of 99942 Apophis. Specifically, they find the IP of Apophis to be lowered by nearly an order of magnitude to 4.5×10^{-6} for the 2036 close approach.
2010, Nov	D. Jewitt, J. Li, 2010, <i>Astronomical Journal</i>, 140, 1519, "Activity in Geminid parent (3200 Phaethon)." See:

	http://adsabs.harvard.edu/abs/2010AJ....140.1519J http://science.nasa.gov/science-news/science-at-nasa/2010/06dec_geminids/
2010, Nov	E. Pierazzo, R.R. Carcia, D.E. Kinnison, D.R. Marsh, J. Lee-Taylor, P.J. Crutzen, 2010, <i>Earth and Planetary Science Letters</i>, 299, 263, "Ozone perturbation from medium-size asteroid impacts in the ocean." See: http://adsabs.harvard.edu/abs/2010E%26PSL.299..263P http://www.newscientist.com/article/dn19579-ocean-asteroid-hits-will-create-huge-ozone-holes.html
2010, Nov	D.P. Rubincam, S.J. Paddock, 2010, <i>Icarus</i>, 209, 863, "Zero secular torque on asteroids from impinging solar photons in the YORP effect: a simple proof." See: http://adsabs.harvard.edu/abs/2010Icar..209..863R
2010, Nov 2, 02:37	Aten NEA 2010 UJ7 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.74 LD. [2010-16] See: 2010 UJ7 - SSA , 2010 UJ7 - JPL
2010, Nov 2, 18:05	Apollo NEA 2010 VN1 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2010-17] See: 2010 VN1 - SSA , 2010 VN1 - JPL
2010, Nov 4	D. Lupishko, Z. Pozhalova, 2010, in: C. Barbieri, M. Coradini, S. Chakrabarti (eds.), Proc. IAU Symposium No. 269 on <i>Galileo's Medicean Moons: their impact on 400 years of discovery</i> (Cambridge: CUP), p. 234, "Near-Earth Objects 400 years after Galileo: physical properties and internal structure." See: http://adsabs.harvard.edu/abs/2010IAUS..269..234L
2010, Nov 4	NASA spacecraft EPOXI successfully flew by comet Hartley 2 at about 7 a.m. PDT. Hartley 2 is the fifth comet nucleus visited by a spacecraft. See: http://epoxi.umd.edu/ http://www.lpi.usra.edu/sbag/meetings/jan2009/presentations/AHearn_SBAG-EPOXI.pdf http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2727 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2754 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2010-346 http://www.jpl.nasa.gov/news/news.cfm?release=2010-371&cid=release_2010-371&msource=e20101104&tr=y&aid=7308484 http://www.jpl.nasa.gov/news/news.cfm?release=2010-373&cid=release_2010-373&msource=10373&tr=y&aid=7313419

	http://www.jpl.nasa.gov/news/news.cfm?release=2010-375&cid=release_2010-375&msource=2010375&tr=y&auid=7321315 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2010-387 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-185
2010, Nov 7	Apollo NEA 2010 VR21 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.92 LD. [2010-18] See: 2010 VR21 - SSA , 2010 VR21 - JPL See also: http://www.space.com/spacewatch/small-asteroid--passing-earth-101116.html
2010, Nov 11	Cameras for Allsky Meteor Surveillance (CAMS). First light. CAMS is an automated video surveillance of the night sky in search of meteors to validate minor showers in the IAU Working List of Meteor Showers. Stations are located in California. See: http://cams.seti.org/ http://www.astro.amu.edu.pl/~jopek/MDC2007/Roje/roje_lista.php?corobic_roje=0&sort_roje=0
2010, Nov 12	Apollo NEA 2010 VP139 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.21 LD. Minimum miss distance 0.02 LD. [2010-19] See: 2010 VP139 - SSA , 2010 VP139 - JPL
2010, Nov 13	Apollo NEA 2010 VC140 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.75 LD. [2010-20] See: 2010 VC140 - SSA , 2010 VC140 - JPL
2010, Nov 14	Apollo NEA 2010 RF181, $H = 20.6$ mag, $D \approx 280$ m, PHA) passed Earth at a nominal miss distance of 4.30 LD. Minimum miss distance 4.30 LD. See: 2010 RF181- JPL , 2010 RF181- SSA
2010, Nov 16	Successful NEA sample return. Particles returned by the JAXA spacecraft Hayabusa on 13 June 2010 have been identified to originate from asteroid 25143 Itokawa (1998 SF36, $H = 19.5$ mag, $D = 520 \times 270 \times 230$ m, $M = 3.6 \times 10^{10}$ kg, PHA). Some 1500 grains with sizes $< 10 \mu\text{m}$ were identified as rocky particles, most of them judged to be of extraterrestrial origin. In August 2010 JAXA received governmental go-ahead for preliminary design work on follow-up asteroid sample return mission Hayabusa 2, aimed for launch in 2014 to reach a carbon-rich asteroid in 2018 for a touch-and-go approach to collect samples, and return to Earth in 2020.

	See: http://hayabusa.jaxa.jp/e/index.html http://www.jaxa.jp/projects/sat/muses_c/index_e.html http://www.jaxa.jp/press/2010/11/20101116_hayabusa_e.html http://blogs.nature.com/news/thegreatbeyond/2010/11/hayabusa_claims_first_dust_from_1.html http://www.scientificamerican.com/blog/post.cfm?id=hayabusa-probe-succeeded-in-return-2010-11-16 http://www.space.com/news/japan-approves-asteroid-probe-new-rocket-100820.html http://science.nasa.gov/science-news/science-at-nasa/2010/30dec_samplereturn/ http://en.wikipedia.org/wiki/25143_Itokawa
2010, Nov 17	Apollo NEA 2010 WA ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.101 LD (= 6.1 R_{Earth} from the geocenter). Minimum miss distance 0.101 LD. [2010-21] See: 2010 WA - SSA , 2010 WA - JPL See also: http://www.space.com/spacewatch/small-asteroid--passing-earth-101116.html http://www.space.com/scienceastronomy/tiny-asteroid-passing-earth-spins-fast-101120.html
2010, Nov 18	Emeritus-Director of the IAU Minor Planet Center Dr. Brian G. Marsden (1937 - 2010) passed away. Ref: - G.V. Williams, 2010, <i>Minor Planet Electronic Circulars</i>, No. 2010-W10, "Brian Marsden (1937 Aug. 5 - 2010 Nov. 18)". See: http://www.minorplanetcenter.org/mpec/K10/K10W10.html#form See also: http://www.iau.org/science/news/115/ http://www.cfa.harvard.edu/news/2010/pr201025.html http://planetary.org/news/2010/1118_Brian_Marsden_1937_2010.html http://www.scientificamerican.com/blog/post.cfm?id=brian-marsden-longtime-director-of-2010-11-18 http://www.scientificamerican.com/article.cfm?id=keeper-of-the-objects http://blogs.nature.com/news/thegreatbeyond/2010/11/and_loses_a_giant_among_minor.html http://www.newscientist.com/blogs/shortsharpscience/2010/11/brian-marsden-the-man-who-made.html http://www.skyandtelescope.com/news/109107254.html http://www.space.com/news/astronomers-brian-marsden-allan-sandage-obits-101119.html http://www.universetoday.com/79392/astronomer-brian-marsden-has-died/ http://www.economist.com/node/17627004 http://en.wikipedia.org/wiki/Brian_G._Marsden

2010, Nov 29	Apollo NEA 2010 XR ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.45 LD. [2010-22] See: 2010 XR - SSA , 2010 XR - JPL
2010, Nov 29 - Dec	Gaia Follow-Up Network (Gaia-FUN) Workshop, hosted by the Institut de Mécanique Céleste et de Calcul des Éphémérides (IMCCE), Paris (France), to discuss and start up a network for follow-up asteroid observations to be made with ESA's Gaia mission, scheduled for launch in Spring 2012. See: http://www.imcce.fr/langues/en/publications/colloques/gaiafun/
2010, Nov 30	Apollo NEA 2010 XB ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.14 LD. Minimum miss distance 0.14 LD. [2010-23] See: 2010 XB - SSA , 2010 XB - JPL
2010, Nov-Dec	D.R. Adamo, J.D. Giorgini, P.A. Abell, R.R. Landis, 2010, <i>Journal of Spacecraft and Rockets</i>, 47, 994, "Asteroid destinations accessible for human exploration: a preliminary survey in mid-2009." See: http://www.aiaa.org/content.cfm?pageid=318&volume=47&issue=6&pubid=25&paperid=48681
2010, Dec	I. de Pater, L.N. Fletcher, S. Pérez-Hoyos, et al., 2010, <i>Icarus</i>, 210, 722, "A multi-wavelength study of the 2009 impact on Jupiter: comparison of high resolution images from Gemini, Keck and HST." See: http://adsabs.harvard.edu/abs/2010Icar..210..722D
2010, Dec	D. Morrison, 2010, <i>Proceedings American Philosophical Society</i>, 154 (4), 439, "Impacts and evolution: protecting Earth from asteroids." (Read also 13 November 2008.) See: http://www.amphilsoc.org/sites/default/files/1540404.pdf
2010, Dec	E.L. Wright, P.R.M. Eisenhardt, A.K. Mainzer, et al., 2010, <i>Astronomical Journal</i>, 140, 1868, "The Wide-Field Infrared Survey Explorer (Wise): mission description and initial on-orbit performance." See: https://ui.adsabs.harvard.edu/abs/2010AJ....140.1868W/abstract
2010, Dec 2	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), <i>Information on research in the field of NEOs carried out by Member States, international organizations and other entities</i>. See: http://www.unoosa.org/pdf/reports/ac105/AC105_976E.pdf http://www.unoosa.org/pdf/limited/AC105_C1_2011_CRP12E.pdf

2010, Dec 5	Apollo NEA 2010 XC ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 4.47 LD. Minimum miss distance 0 LD. See: 2010 XC - SSA , 2010 XC - JPL
2010, Dec 7	S. Merikallio, P. Janhunen, 2010, <i>Astrophys. Space Sci. Trans.</i> , 6, 41, "Moving an asteroid with electric solar wind sail." Winning paper of the 2009 Space Generation Advisory Council <i>Move An Asteroid Competition</i> . See: http://www.astrophys-space-sci-trans.net/6/41/2010/astra-6-41-2010.pdf
2010, Dec 7	IAU announced the formation of a new IAU Working Group on Near Earth Objects under IAU Division III, created 1 October 2010. See: http://www.iau.org/science/news/119/ http://www.iau.org/science/scientific_bodies/working_groups/171/
2010, Dec 9	Apollo NEA 529668 (2010 JL33) , $H = 17.7$ mag, $D = 1000$ m, PHA) passed Earth at a nominal miss distance of 16.6 LD. Minimum miss distance 16.6 LD. This asteroid, discovered on 6 May 2010 by the Catalina Sky Survey , is one of 14 new NEAs with $D > 1$ km discovered in this decade. Its rotation period $P = 9$ hr. Radar imaging at NASA's Goldstone Solar System Radar in the California desert was obtained on 11 and 12 December 2010. A video of the radar images was released by NASA on 11 January 2011. See: 2010 JL33 - SSA , 2010 JL33 - JPL See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-011 http://www.nasa.gov/multimedia/videogallery/index.html?media_id=51265981 See also: http://adsabs.harvard.edu/abs/2018arXiv180208904Y
2010, Dec 10	W.F. Bottke, R.J. Walker, J.M.D. Day, et al., 2010, <i>Science</i> , 330, 1527, "Stochastic late accretion to Earth, the Moon, and Mars." See: http://adsabs.harvard.edu/abs/2010Sci...330.1527B
2010, Dec 10	L. David, 2010, <i>Space.com</i> , "U.S. military in talks to share Fireball data from secret satellites." See: http://www.space.com/news/military-satellites-fireball-data-talks-101210.html
2010, Dec 11	Iran Fireball . Intensely bright fireball meteor flashed on 11 December 2010 through the cold, clear, early morning skies over the Karkas Mountains in central Iran, near the peak of the annual Geminid Meteor Shower .

	See: http://apod.nasa.gov/apod/ap101217.html
2010, Dec 16	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) , <i>Near-Earth objects, 2010-2011, Interim report of-Action Team 14 on Near-Earth Objects</i> . See: http://www.unoosa.org/pdf/limited/c1/AC105_C1_L308E.pdf
2010, Dec 21	L. David, 2010, <i>Space.com</i> , "Experts push for a NASA asteroid-hunting spacecraft." See: http://www.space.com/news/nasa-neo-asteroid-spacecraft-101221.html
2011, Jan 1	7566 NEAs known (ranging in size up to ~37 km: 1036 Ganymed , A924 UB , $H = 9.45$ mag, $D = 36.5$ km, Amor NEA), of which 1177 PHAs (ranging in size from 140 m up to ~5 km: 4179 Toutatis , 1989 AC , $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, Apollo NEA, PHA). See: http://neo.jpl.nasa.gov/stats/
2011	On NATO and Space Situational Awareness, related to space weather, space debris and Near Earth Objects. See: http://www.rta.nato.int/ACTIVITY_META.asp?ACT=SCI-229
2011, Jan	G. Cordero, A. Poveda, 2011, <i>Planetary and Space Science</i> , 59, 10, " Curuça 1930 : A probable mini- Tunguska ?" See also item of 13 August 1930. See: http://adsabs.harvard.edu/abs/2011P%26SS...59...10C
2011, Jan	J.L. Tonry, 2011, <i>Publ. Astron. Soc. Pacific</i> , 123, 58, "An early warning system for asteroid impact." See: http://adsabs.harvard.edu/abs/2011PASP..123...58T See also: http://fallingstar.com/ http://www.space.com/8986-asteroid-threat-early-warning-system-proposed.html http://www.space.com/9629-week-warning-asteroid-strike-simple-scientist.html
2011, Jan	J. Žižka, D. Vokrouhlický, 2011, <i>Icarus</i> , 211, 511, "Solar radiation pressure on (99942) Apophis ." See: http://adsabs.harvard.edu/abs/2011Icar..211..511Z See also: http://content.usatoday.com/communities/sciencefair/post/2010/11/apophis-asteroid-2013/1
2011, Jan	G.S. Orton, L.N. Fletcher, P.W. Chodas, et al., 2011, <i>Icarus</i> , 211, 587, "The atmospheric influence, size and possible asteroidal nature of the July 2009 Jupiter impactor ."

	See: http://adsabs.harvard.edu/abs/2011Icar..211..587O
2011, Jan 3	Aten NEA 2011 AE3 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 2.21 LD. Minimum miss distance 0 LD. See: 2011 AE3 - SSA , 2011 AE3 - JPL
2011, Jan 11	Apollo NEA 2011 AM37 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.33 LD. Minimum miss distance 0.33 LD. [2011-01] See: 2011 AM37 - SSA , 2011 AM37 - JPL
2011, Jan 17	Apollo NEA 2011 AN52 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.83 LD. Minimum miss distance 0.83 LD. [2011-02] See: 2011 AN52 - SSA , 2011 AN52 - JPL
2011, Jan 20	Apollo NEA 2011 BY10 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.93 LD. Minimum miss distance 0.92 LD. [2011-03] See: 2011 BY10 - SSA , 2011 BY10 - JPL
2011, Jan 24-26	Fourth NASA Small Bodies Assessment Group Meeting, Washington (DC, USA). See: http://www.lpi.usra.edu/sbag/meetings/ http://www.lpi.usra.edu/sbag/meetings/jan2011/poster.pdf http://www.lpi.usra.edu/sbag/meetings/jan2011/agenda.shtml Findings: https://www.lpi.usra.edu/sbag/findings/ Among the presentations: - M.V. Sykes, 2011, "Science and exploration of small bodies in the solar system." See: http://www.lpi.usra.edu/sbag/meetings/jan2011/presentations/day1/d1_103_0_panel_charge.pdf - J.A. Nuth, 2011, "Small body science issues." See: http://www.lpi.usra.edu/sbag/meetings/jan2011/presentations/day2/d2_134_5_Nuth.pdf - Y. Fernandez, 2011, "Roadmap: population identification and characterization." See: http://www.lpi.usra.edu/sbag/meetings/jan2011/presentations/day2/d2_143_0_Fernandez.pdf - T. Farnham, 2011, " EPOXI results and future proposals for the spacecraft." See: http://www.lpi.usra.edu/sbag/meetings/jan2011/presentations/day3/d3_130_0_Farnham.pdf - M. Zolensky, 2011, " Hayabusa update." See: http://www.lpi.usra.edu/sbag/meetings/jan2011/presentations/day3/d3_133_0_Zolensky_Hayabusa.pdf

2011, Jan 25	Apollo NEA 2011 BW11 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.33 LD. [2011-04] See: 2011 BW11 - SSA , 2011 BW11 - JPL
2011, Jan 31	Apollo NEA 2011 CA4 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.64 LD. Minimum miss distance 0.64 LD. [2011-05] See: 2011 CA4 - SSA , 2011 CA4 - JPL
2011, Jan 31	Press release, Institute for Astronomy, University of Hawaii (HI, USA), 9 March 2011, "Hawaii astronomers keep tabs on asteroid Apophis." On January 31 University of Hawaii at Manoa astronomers used the UH 2.2-meter telescope on Mauna Kea to take the first new images in over three years of the potentially dangerous near-Earth asteroid Apophis as it emerged from behind the Sun. See: http://www.ifa.hawaii.edu/info/press-releases/Apophis2011Jan/ http://www.space.com/11094-watching-asteroid-apophis-photo.html http://www.space.com/10047-collision-watch.html
2011, Feb	First light of the DARPA Space Surveillance Telescope (SST). See: http://www.darpa.mil/program/space-surveillance-telescope http://www.defensenews.com/articles/bulgaria-amends-aircraft-tender-criteria-with-f-16-in-mind https://en.wikipedia.org/wiki/Space_Surveillance_Telescope
2011, Feb	S.G. Djorgovski, A.J. Drake, A.A. Mahabal, in: T. Mihara & N. Kawai (eds.), 2011, <i>The first year of MAXI: Monitoring Variable X-ray Sources</i>, Proc. International Conference, Aoyama (Tokyo, Japan) 30 November - 2 December 2010 (Tokyo: JAXA Special Publication), "The Catalina Real-Time Transient Survey". See: http://maxi.riken.jp/FirstYear/proceedings/procindex.html The Catalina Sky Survey for NEO detection and tracking has as by-product the Catalina Real-time Transient Survey: watching for transient events among the background stars and galaxies. The CRTS has collected 20 billion brightness measurements of 198 million stars and other objects, i.e. an average of 100 brightness measurements for each one. The objects range from 12.5 to 20 mag and span an area of just over half the celestial sphere. Ref.: - A.J. Drake, S.G. Djorgovski, A. Mahabal, et al., 2012, in: R.E.M. Griffin, R.J. Hanisch, R. Seaman (eds.), <i>New horizons in time-domain astronomy</i>, Proc. IAU Symposium No. 285 (Cambridge: CUP), p. 306, "The Catalina Real-time Transient Survey." See: http://adsabs.harvard.edu/abs/2012IAUS..285..306D See also:

	http://www.skyandtelescope.com/news/137519153.html http://crts.caltech.edu/ http://nesssi.cacr.caltech.edu/DataRelease/
2011, Feb	S.-P. Gong, J.-F. Li, Y.-F. Gao, 2011, <i>Research in Astronomy and Astrophysics</i>, 11, 205, "Dynamics and control of a solar collector system for near Earth object deflection." See: http://adsabs.harvard.edu/abs/2011RAA....11..205G
2011, Feb	T.V. Gudkova, Ph. Lognonné, J. Gagnepain-Beyneix, 2011, <i>Icarus</i>, 211, 1049, "Large impacts detected by the Apollo seismometers: impactor mass and source cutoff frequency estimations." See: http://adsabs.harvard.edu/abs/2011Icar..211.1049G
2011, Feb	M.M. Marinova, O. Aharonson, E. Asphaug, 2011, <i>Icarus</i>, 211, 960, "Geophysical consequences of planetary-scale impacts into a Mars-like planet." See: http://adsabs.harvard.edu/abs/2011Icar..211..960M
2011, Feb 1	NASA's NEOWISE (see 14 Dec 2009) mission completed its survey of asteroids and comets. The mission's discoveries of previously unknown objects include 20 comets, more than 33,000 main belt asteroids and 134 Near-Earth Asteroids. See: http://wise.ssl.berkeley.edu/ http://www.jpl.nasa.gov/news/news.php?release=2013-257 http://www.jpl.nasa.gov/news/news.php?release=2013-373 Ref: - A. Mainzer, J. Bauer, T. Grav, et al., 2011, <i>Astrophysical Journal</i>, 731, 53, "Preliminary results from NEOWISE: an enhancement to the Wide-field Infrared Survey Explorer for Solar System science." See: http://adsabs.harvard.edu/abs/2011ApJ...731...53M - A. Mainzer, T. Grav, J. Masiero, et al., 2012, <i>Astrophysical Journal</i>, 752, 110, "Characterizing subpopulations within the Near Earth Objects with NEOWISE: preliminary results." See: http://adsabs.harvard.edu/abs/2012ApJ...752..110M See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-031 http://www.space.com/10735-asteroid-survey-space-rocks-comets.html http://www.jpl.nasa.gov/news/news.cfm?release=2011-117&cid=release_2011-117&msource=11117&tr=y&auid=8164024 http://www.jpl.nasa.gov/video/index.cfm?id=935
2011, Feb 4, 19:39	Aten NEA 2011 CQ1 ($H = 31.9$ mag, $D \approx 1.5$ m) passed Earth at a nominal miss distance of 0.031 LD (= 1.86 R_{Earth} from the geocenter) over the mid-Pacific. Minimum miss distance 0.031 LD. [2011-06]

	This object is the closest non-impacting object in the Minor Planet Center asteroid catalog to date. Prior to the Earth close approach, this object was in a so-called Apollo-class orbit that was mostly outside the Earth's orbit. Following the close approach, the Earth's gravitational attraction modified the object's orbit to an Aten-class orbit where the asteroid spends almost all of its time inside the Earth's orbit. See: 2011 CQ1 - SSA , 2011 CQ1 - JPL See also: http://neo.jpl.nasa.gov/news/news170.html http://www.space.com/10927-asteroid-2011cq1-record-close-pass-earth.html See also: http://neo.ssa.esa.int/newsletters [June 2020] http://en.wikipedia.org/wiki/2011_CQ1
2011, Feb 4, 23:08	Aten NEA 2011 CH22 ($H = 27.1$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 3.29 LD. Minimum miss distance 0 LD. See: 2011 CH22 – SSA , 2011 CH22 – JPL
2011, Feb 4	February Eta Draconids. A meteor outburst was detected in Cameras for Allsky Meteor Surveillance (CAMS) February 4 data, obtained at the Fremont Peak (Rick Morales, Loren Dynneson, et al.) and Mountain View (Peter Jenniskens) stations. This is the first new shower discovered by CAMS. It is also a very unusual shower, of a type that only occurs once or twice every sixty years and is caused by the dust trail of a (still to be discovered) Potentially Hazardous long-period Comet. The new shower was named the February Eta Draconids and is now listed as shower 427 in the IAU Working List of Meteor Showers. Ref: - P. Jenniskens, P.S. Gural, 2011, <i>WGN, Journal of the International Meteor Organization</i>, 39, 93, "Discovery of the February Eta Draconids (FED, IAU#427): the dust trail of a potentially hazardous long-period comet." See: http://www.imo.net/imo/wgn See also: http://cams.seti.org/FED.pdf http://cams.seti.org/ http://cams.seti.org/CBET2763.txt http://www.astro.amu.edu.pl/~jopek/MDC2007/Roje/roje_lista.php?corobic_roje=0&sort_roje=0 http://www.space.com/12450-unknown-comet-earth-threat-meteor-shower-evidence.html
2011, Feb 6	Apollo NEA 2011 CF22 ($H = 30.9$ mag, $D \approx 2.4$ m) passed Earth at a nominal miss distance of 0.105 LD (= 6.31 R_{Earth} from the geocenter). Minimum miss distance 0.092 LD. [2011-07]

	See: 2011 CF22 - SSA , 2011 CF22 - JPL
2011, Feb 7	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) , <i>Information on research in the field of NEOs carried out by Member States, international organizations and other entities.</i> See: http://www.unoosa.org/pdf/limited/AC105_C1_2011_CRP12E.pdf
2011, Feb 8	C. Kazan, 2011, <i>Daily Galaxy</i> , 8 February 2011, "Tracking the realtime threat of near-Earth asteroids & comets – could it save the planet?" See: http://www.dailygalaxy.com/my_weblog/2011/02/tracking-the-realtime-threat-of-near-earth-asteroids-will-it-save-the-planet.html
2011, Feb 9	Apollo NEA 2011 CA7 ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.27 LD. [2011-08] See: 2011 CA7 - SSA , 2011 CA7 - JPL See also: http://www.scientificamerican.com/blog/post.cfm?id=record-setting-near-miss-of-earth-d-2011-02-10 http://www.space.com/10800-car-size-asteroid-passing-earth.html
2011, Feb 14	NASA's <i>Stardust-NEXT</i> spacecraft flew by comet Temple 1 . See: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-053 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-054 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-056 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-094
2011, Feb 14	NASA announces Fiscal Year 2012 Budget. Funds for NEO observations would quadruple to US \$20.4 million. See: http://www.nasa.gov/news/budget/index.html http://news.sciencemag.org/scienceinsider/2011/02/climate-science-asteroid-detection.html?ref=ra
2011, Feb 14-16	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) Scientific and Technical SubCommittee, 48th Session, WG NEO and Action Team 14 on NEOs , chaired by Sergio Camacho (Mexico), meets in Vienna (Austria). Report: http://www.unoosa.org/oosa/en/COPUOS/stsc/2011/index.html http://www.unoosa.org/pdf/reports/ac105/AC105_987E.pdf Statements: Thomas D. Jones, chair, ASE Committee on Near-Earth Objects, Statement by the Association of Space Explorers, < http://... >. Technical presentations: - A. Grovas (Mexico), "First scientific light of the GMT, millimetric telescope". See: http://www.oosa.unvienna.org/pdf/pres/stsc2011/tech-

	32.pdf - W. Ailor (IAA), "Planetary Defense Conferences: sharing information on NEO threats and mitigation". See: http://www.oosa.unvienna.org/pdf/pres/stsc2011/tech-36.pdf - T. Jones (ASE), "Results from the Near-Earth Objects Mission Planning and Operations Group workshop". See: http://www.oosa.unvienna.org/pdf/pres/stsc2011/tech-38.pdf - D. Yeomans (USA), "Spaceguard program". See: http://www.oosa.unvienna.org/pdf/pres/stsc2011/tech-42.pdf - T. Yamada (Japan), "Dawn of the age of solar system exploration – Hayabusa, Ikaros, and future ". See http://www.oosa.unvienna.org/pdf/pres/stsc2011/tech-45.pdf - B. Shustov (Russian Federation), "Towards national near-Earth objects program". See: http://www.oosa.unvienna.org/pdf/pres/stsc2011/tech-47.pdf
2011, Feb 15	P. Tanga, 2011, in: C. Turon, F. Meynadier & F. Arenou (eds.), Proc. International Conference Gaia: <i>at the frontiers of astrometry</i>, 7-11 June 2010, Sèvres (France), <i>ESA Publication Series</i>, 45, 225, "Solar System science: Gaia and other forthcoming surveys." See: http://adsabs.harvard.edu/abs/2011EAS....45..225T See also: http://www.hip.obspm.fr/gaia2010/IMG/pdf/Abstract_booklet.pdf http://www.eas-journal.org/index.php?option=com_article&access=doi&doi=10.1051/eas/1045038&Itemid=129
2011, Feb 18	R.A. Kerr, 2011a, <i>Science</i>, 331, 841, "NASA weighs asteroids: cheaper than Moon, but still not easy." See: http://adsabs.harvard.edu/abs/2011Sci...331..841K
2011, Feb 18	R.A. Kerr, 2011b, <i>Science</i>, 331, 843, "A windfall for defenders of the planet." See: http://adsabs.harvard.edu/abs/2011Sci...331..843K
2011, Feb 22	Open Global Community NEO Workshop Target NEO: Providing a resilient NEO accessibility program for human exploration beyond low Earth orbit, 22 February 2011, George Washington University, School of Media and Public Affairs, Washington, DC (USA). See: http://targetneo.jhuapl.edu/ http://targetneo.jhuapl.edu/sessions.html http://www.space.com/11189-nasa-asteroid-choice-astronauts-deep-space.html Final report: http://targetneo.jhuapl.edu/pdfs/2013_Presentations/TargetNEO2WorkshopReport.pdf Some of the presentations: - T. Jones, 2011, "NEO search reduces risk".

	- T.B. Spahr, 2011, "Minor Planet Center, operations and update." - - D.K. Yeomans, 2011, "Precision NEO orbit prediction at JPL." - J.S. Stuart, 2011, "Searching for asteroids." - A. Mainzer, 2011, "Space-based NEO detection and tracking: NEOWISE and beyond." - A.W. Harris, 2011, "NEO population." - P. Michel, 2011, "Physical properties of NEOs from observations, and their influence for the design of a human mission." - L. Benner, 2011, "Arecibo and Goldstone radar characterization of NEO mission targets." - J.A. Nuth, 2011, "Do we really understand the rocks that astronauts might be visiting." - D.J. Scheeres, P. Sánchez, 2011, "Can small, fast spinning asteroids be rubble piles?" - A. Cheng, 2011, "NEO orbit simulation approach." - L. Jones, 2011, "NEO detection capabilities of LSST." - K. Hibbard, 2011, "Near-Earth Survey Telescope (NEST). Human robotic precursor mission concept." - A. Mainzer, 2011, "Next-generation space-based IR NEO surveys." - R. R. Arentz, 2011, "A candidate NEO survey mission for affordable human spaceflight target assurance."
2011, Feb 23	Apollo NEA 2011 DU9 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.75 LD. [2011-09] See: 2011 DU9 - SSA , 2011 DU9 - JPL
2011, Feb 25	ESA selected four candidates for a medium-class mission within the Cosmic Vision programme that will launch in the period 2020-22 for an initial Assessment Phase study. Among these candidates is Marco Polo-R, a sample return mission to a Near Earth Asteroid. See: http://www.oca.eu/MarcoPolo-R/ Ref: - M.A. Barucci, M. Yoshikawa, P. Michel, et al., 2009, <i>Experimental Astronomy</i>, 23, 785, "Marco Polo: near earth object sample return mission." See: http://adsabs.harvard.edu/abs/2009ExA....23..785B - P. Michel, A. Barucci, D. Koschny, et al., 2009, in: Proc. 72nd Annual Meeting of the Meteoritical Society, 13-18 July 2009, Nancy (France), <i>Meteoritics and Planetary Science Supplement</i>, p.5261, "Marco Polo: a sample return mission to a primitive Near-Earth Object in assessment study in the ESA program Cosmic Vision 2015-2025." See: http://adsabs.harvard.edu/abs/2009M%26PSA..72.5261M - J. de León, T. Mothé-Diniz, J. Licandro, et al., 2011, <i>Astronomy & Astrophysics</i>, 530, id.L12, "New observations of asteroid (175706) 1996 FG3, primary target of the ESA Marco Polo-R mission."

	See: http://adsabs.harvard.edu/abs/2011A%26A...530L..12D - M.A. Barucci, A.F. Cheng, P. Michel, et al., 2012, <i>Experimental Astronomy</i>, 33, 645, "MarcoPolo-R near earth asteroid sample return mission." See: http://adsabs.harvard.edu/abs/2012ExA....33..645B - M.A. Barucci, P. Michel, A. Cheng, et al., 2012, LPI Contribution No. 1659, p.1457, "MarcoPolo-R: Near Earth Asteroid sample return mission selected for ESA assessment study phase." See: http://adsabs.harvard.edu/abs/2012LPI....43.1457B - R.P. Binzel, D. Polishook, F.E. DeMeo, et al., 2012, LPI Contribution No. 1659, p.2222, "Marco Polo-R target asteroid (175706) 1996 FG3: possible evidence for an annual thermal wave." See: http://adsabs.harvard.edu/abs/2012LPI....43.2222B - A.S. Rivkin, E.S. Howell, F.E. DeMeo, et al., 2012, LPI Contribution No. 1659, p.1537, "New observations and proposed meteorite analogs of the MarcoPolo-R target asteroid (175706) 1996 FG3." See: http://adsabs.harvard.edu/abs/2012LPI....43.1537R - K.J. Walsh, M. Delbo, M. Mueller, R.P. Binzel, F.E. DeMeo, 2012, <i>Astrophysical Journal</i>, 748, 104, "Physical characterization and origin of binary Near-Earth Asteroid (175706) 1996 FG3." See: http://adsabs.harvard.edu/abs/2012ApJ...748..104W - L.A.M. Benner, M. Brozovic, J.D. Giorgini, et al., 2012, American Astronomical Society, DPS meeting #44, #102.06, "Arecibo and Goldstone Radar Observations of binary Near-Earth Asteroid and Marco Polo-R mission target (175706) 1996 FG3." See: http://adsabs.harvard.edu/abs/2012DPS....4410206B - C. Lantz, E. Dotto, M.A. Barucci, et al., 2012, American Astronomical Society, DPS meeting #44, #215.02, "The European sample return mission MarcoPolo-R: understanding the nature of extraterrestrial primitive materials and tracing the origins." See: http://adsabs.harvard.edu/abs/2012DPS....4421502L See also: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=48467 http://smass.mit.edu/MarcoPolo/home.html http://www.oca.eu/MarcoPolo-R/Workshops/WorkshopsMarcoPolo-R.html
2011, Feb 26	Apollo NEA 367789 (2011 AG5, $H = 22.0$ mag, $D \approx 140$ m, PHA) passed Earth at a nominal miss distance of 37.2 LD. Minimum miss distance 37.2 LD. See: 367789 2011 AG5 - SSA , 2011 AG5 - JPL See also: http://en.wikipedia.org/wiki/2011_AG5 See also: 3 Feb 2023, 4 Feb 2040.
2011, Feb 27	C.Y. Johnson, 2011, <i>The Boston Globe</i>, 27 February 2011, "Just another asteroid hurtling toward Earth"

	See: http://www.boston.com/news/science/articles/2011/02/27/local_scientists_study_asteroids_for_clues_potential_threats/
2011, Feb 28	T. Friend, 2011, <i>The New Yorker</i> , 28 February 2011, p. 22, "Vermin of the sky." See: http://www.newyorker.com/reporting/2011/02/28/110228fa_fact_friend
2011, Mar	M. Delbò, K. Walsh, M. Mueller, A.W. Harris, E.S. Howell, 2011, <i>Icarus</i> , 212, 138, "The cool surfaces of binary near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2011Icar..212..138D
2011, Mar	S.K. Fieber-Beyer, M.J. Gaffey, P.A. Abell, 2011, <i>Icarus</i> , 212, 149, "Mineralogical characterization of near-Earth Asteroid (1036) Ganymed ." See: http://adsabs.harvard.edu/abs/2011Icar..212..149F
2011, Mar	M. Fischetti, 2011, <i>Scientific American</i> , 304, 80, "Death by asteroid." See: http://www.nature.com/scientificamerican/journal/v304/n3/full/scientificamerican0311-80.html
2011, Mar	A.W. Harris, M. Mommert, J.L. Hora, et al., 2011, <i>Astronomical Journal</i> , 141, 75, "ExploreNEOs. II. The accuracy of the Warm Spitzer Near-Earth Object Survey ." See: http://adsabs.harvard.edu/abs/2011AJ....141...75H See also: https://www.jpl.nasa.gov/news/news.php?feature=7575
2011, Mar	V. Reddy, A. Nathues, M.J. Gaffey, 2011, <i>Icarus</i> , 212, 175, "First fragment of asteroid 4 Vesta 's mantle detected." The fragment is NEA (237442) 1999 TA10 ($H = 17.9$ mag, $D \approx 900$ m). See: http://adsabs.harvard.edu/abs/2011Icar..212..175R See also: http://www.mpg.de/877913/Pressrelease20110106 http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=1999+TA10+&orb=1 http://en.wikipedia.org/wiki/(237442)_1999_TA10
2011, Mar 1	NASA's Mars Exploration Rover Opportunity has nearly completed its three-month examination of an impact crater on Mars informally named " Santa Maria ", but before the rover resumes its overland trek, an orbiting camera has provided a color image of Opportunity beside Santa Maria . The High Resolution Imaging Science Experiment (HiRISE) camera on NASA's Mars Reconnaissance Orbiter acquired the image on March 1. Santa Maria crater is ~ 90 m in diameter. See: http://www.jpl.nasa.gov/news/news.cfm?release=2011-

	072&cid=release_2011-072&msource=11072&tr=y&auid=7906048
2011, Mar 2	NASA established a network of smart cameras to keep a robotic vigil on the roughly 100 tons of meteoroids that slam into Earth every day. The cameras are operated by the NASA All-sky Fireball Network of the NASA Meteoroid Environment Office , established in October 2004. See: http://fireballs.ndc.nasa.gov/ http://www.nasa.gov/offices/meo/home/aboutMEO-rd.html http://www.space.com/11010-nasa-tracks-meteor-fireballs-robot-cameras.html
2011, Mar 3	Apollo NEA 2011 EN11 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.64 LD. [2011-10] See: 2011 EN11 - SSA , 2011 EN11 - JPL
2011, Mar 4	ESA <i>Space Science News</i> , 4 March 2011, "The scars of impacts on Mars ." See: www.esa.int/esaSC/SEMTK5VTLKG_index_0.html
2011, Mar 7	Apollo NEA 2011 EY11 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2011-11] See: 2011 EY11 - SSA , 2011 EY11 - JPL
2011, Mar 7-11	42nd Lunar and Planetary Science Conference , 7-11 March 2011, The Woodlands (TX, USA). See: http://www.lpi.usra.edu/meetings/lpsc2011/ Among the presentations: - R.P. Binzel, F.E. DeMeo, M. Lockhart, et al., 2011, LPI Contribution No. 1608, p.2226, "Spectral reconnaissance for 200 Near-Earth Object mission targets." See: http://adsabs.harvard.edu/abs/2011LPI....42.2226B - F.E. DeMeo, R.P. Binzel, 2011, LPI Contribution No. 1608, p.2055, "SMASS-Next: A next generation asteroid spectroscopic survey." See: http://adsabs.harvard.edu/abs/2011LPI....42.2055D
2011, Mar 8	Apollo NEA 2011 EM40 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.63 LD. Minimum miss distance 0.63 LD. [2011-12] See: 2011 EM40 - SSA , 2011 EM40 - JPL
2011, Mar 16	Aten NEA 2011 EB74 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.85 LD. Minimum miss distance 0.58 LD. [2011-13] See: 2011 EB74 - SSA , 2011 EB74 - JPL See also:

	http://www.space.com/11145-small-asteroid-2011eb74-passing-earth.html
2011, Mar 30	J. Matson, 2011, <i>Scientific American</i> , 30 March 2011, "Which near-Earth asteroids are ripe for a visit?" See: http://blogs.scientificamerican.com/observations/2011/03/30/which-near-earth-asteroids-are-ripe-for-a-visit/
2011, Mar-Apr	G.L. Matloff, M. Wilga, 2011, <i>Acta Astronautica</i> , 68, 599, "NEOs as stepping stones to Mars and main-belt asteroids." See: http://adsabs.harvard.edu/abs/2011AcAau..68..599M
2011, Apr	M.W. Busch, S.J. Ostro, L.A.M. Benner, et al., 2011, <i>Icarus</i> , 212, 649, "Radar observations and the shape of Near-Earth Asteroid 2008 EV5 ." See: http://adsabs.harvard.edu/abs/2011Icar..212..649B Corrigendum: https://ui.adsabs.harvard.edu/abs/2019Icar..333..548B/abstract
2011, Apr	S.R. Chesley, 2011, <i>Bulletin of the American Astronomical Society</i> , 43, 2011, "Asteroid impact hazard assessment over Long time intervals." See: http://adsabs.harvard.edu/abs/2011DDA....42.0601C
2011, Apr	M. Mueller, M. Delbò, J.L. Hora, et al., 2011, <i>Astronomical Journal</i> , 141, 109, "ExploreNEOs. III. Physical characterization of 65 potential spacecraft target asteroids." See: http://adsabs.harvard.edu/abs/2011AJ....141..109M See also: http://www.scientificamerican.com/blog/post.cfm?id=which-near-earth-asteroids-are-ripe-2011-03-30
2011, Apr 5	A. Mann, 2011, <i>Nature</i> , 472, 16, "NASA human space-flight programme lost in transition." See: http://www.nature.com/news/2011/110405/full/472016a.html
2011, Apr 6, 04:54	Apollo NEA 2011 GW9 ($H = 28.4$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.52 LD. [2011-14] See: 2011 GW9 - JPL , 2011GW9 - SSA
2011, Apr 6, 19:38	Apollo NEA 2011 GP28 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.25 LD. [2011-15] See: 2011 GP28 - SSA , 2011 GP28 - JPL
2011, Apr 7	E. Lu, 2011, <i>Nature</i> , 472, 28, "Deflect risky asteroids." Embedded in article "NASA: what now?" <i>Nature</i> , 472, 27-29.

	See: http://adsabs.harvard.edu/abs/2011Natur.472R..28L
2011, Apr 10	A. Mainzer, J. Bauer, T. Grav, et al., 2011, <i>Astrophysical Journal</i> , 731, 53, "Preliminary results from NEOWISE : an enhancement to the Wide-field Infrared Survey Explorer for Solar System science." See: http://adsabs.harvard.edu/abs/2011ApJ...731...53M See also: http://apod.nasa.gov/apod/ap111001.html
2011, Apr 15	R.E. Kerr, 2011, <i>Science</i> , 332, 302, "Asteroid model shows early life suffered a billion-year battering." Report on presentation at <i>Lunar and Planetary Science Conference</i> , 7-11 March 2011, The Woodlands (TX, USA). See: http://www.sciencemag.org/content/332/6027/302.1.summary
2011, Apr 15	R.E. Kerr, 2011, <i>Science</i> , 332, 302, "Prime science achieved at asteroid." Report on Itokawa particles returned by Hayabusa , presented at <i>Lunar and Planetary Science Conference</i> , 7-11 March 2011, The Woodlands (TX, USA). See: http://www.sciencemag.org/content/332/6027/302.2.summary
2011, Apr 15	Aten NEA 2011 GP59 ($H = 24.5$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 1.39 LD. Minimum miss distance 1.39 LD. $P_{\text{rot}} \approx 7.5$ min and blinking. See: 2011 GP59 - SSA , 2011 GP59 - JPL See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-118 http://www.youtube.com/watch?v=O7wsAZNr56E
2011, Apr 19	Asteroid 2006 HF6 ($H = 24.6$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 4.53 LD. Minimum miss distance 0.94 LD. See: 2006 HF6 - SSA , 2006 HF6 - JPL
2011, Apr 25	Apollo NEA 2011 JA , $H = 21.2$ mag, $D \approx 210$ m, PHA) passed Earth at a nominal miss distance of 1.62 LD. Minimum miss distance 1.62 LD. See: 2011 JA- JPL , 2011 JA- SSA
2011, May	O. Abramov, S.J. Mojzsis, 2011, <i>Icarus</i> , 213, 273, "Abodes for life in carbonaceous asteroids?" See: http://adsabs.harvard.edu/abs/2011Icar..213..273A
2011, May	J. Fang, J.-L. Margot, M. Brozovic, et al., 2011, <i>Astronomical Journal</i> , 141, 154, "Orbits of Near-Earth Asteroid triples 2001 SN263 and 1994 CC : properties, origin, and evolution." See: http://adsabs.harvard.edu/abs/2011AJ....141..154F See also:

	http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2259 http://en.wikipedia.org/wiki/(136617)_1994_CC
2011, May	C.I. Fassett, S.J. Kadish, J.W. Head, et al., 2011, <i>Geophysical Research Letters</i> , 38(10), L10202, "The global population of large craters on Mercury and comparison with the Moon." See: http://adsabs.harvard.edu/abs/2011GeoRL..3810202F
2011, May	S. Mouret, F. Mignard, 2011, <i>Monthly Notices Royal Astronomical Society</i> , 413, 741, "Detecting the Yarkovsky effect with the Gaia mission: list of the most promising candidates." See: http://adsabs.harvard.edu/abs/2011MNRAS.413..741M
2011, May 5	NASA announces the selection of proposals for technology development, including NEOCam , an infrared telescope operating at the L1 Lagrange point to study the origin and evolution of NEOs and study the present risk of Earth-impact. It would generate a catalog of objects and accurate infrared measurements to provide a better understanding of small bodies that cross our planet's orbit. Amy Mainzer of JPL is principal investigator. NEOCam , a 50 cm diameter telescope operating at two heat-sensing infrared wavelengths will carry out a four year baseline survey to find 2/3 of the near-Earth objects larger than 140 m (large enough to cause major regional damage in the event of an Earth impact). By using two heat-sensitive infrared imaging channels, NEOCam can make accurate measurements of NEO sizes and can gain valuable information about their composition, shapes, rotational states, and orbits. See: http://neocam.ipac.caltech.edu/ See also: http://blogs.discovermagazine.com/badastronomy/2012/06/28/privately-and-publicly-looking-for-earth-threatening-asteroids/ http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2013-135 http://neocam.ipac.caltech.edu/news/tracking-sensor-passes-test https://www.lpi.usra.edu/sbag/findings/index.shtml#jan2018
2011, May 5	Apollo NEA 2011 JV10 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.90 LD. Minimum miss distance 0.90 LD. [2011-16] See: 2011 JV10 - SSA , 2011 JV10 - JPL
2011, May 9-12	2011 IAA Planetary Defense Conference, From Threat to Action , Bucharest (Romania), 9-12 May 2011, sponsored by ESA, NASA and, <i>inter alia</i> , the IAU. See: http://pdc.iaaweb.org/?q=content/2011-bucharest http://www.nss.org/resources/library/planetarydefense/WhitePaper-

	2009PlanetaryDefenseConference.pdf http://iaaweb.org/content/view/426/589/ http://www.planetary.org/blog/article/00003026/ http://www.planetary.org/blog/article/00003028/ http://ieet.org/index.php/IEET/more/sandberg20110513 Conference report: http://iaaweb.org/iaa/Scientific%20Activity/pdc2011.pdf Presentations: Session 1 - D. Morrison, "Historical overview of the cosmic impact hazard." - R. Crowther, R. Tremayne-Smith, "Responding to the Near Earth Object (NEO) impact threat through appropriate policy initiatives." - A.W. Harris, and the NEOShield Consortium, "A global approach to near-Earth object impact threat mitigation." See also: http://elib.dlr.de/70019/ Report on the international NEOShield project to address impact hazard mitigation issues, contained in a proposal to the European Commission FP7 Space Programme Call 2011, entitled <i>Prevention of impacts from near-Earth objects on our planet</i>. Session 2 - A.W. Harris, 2011, "Update of estimated NEO population and current survey completion." - D.K. Yeomans, A.B. Chamberlin, 2011, "Comparing the Earth impact flux from comets and near-Earth asteroids." - R. Wainscoat, R. Jedicke, L. Denneau, et al., 2011, "The Pan-STARRS search for Near Earth Asteroids: present status and future plans." - D. Hestroffer, D. Bancelin, W. Thuillot, P. Tanga, 2011, "Gaia Astrometry of Near-Earth Objects." - A. Hildebrand, B. Gladman, E.F. Tedesco, et al., 2011, "The Near Earth Object Surveillance Satellite (NEOSSat) will search near-Sun along the ecliptic plane to efficiently discover objects of the Aten and Atira orbital classes." - P.A. Abell, R.G. Mink, J.B. Garvin, et al., 2011, "A space-based Near-Earth Object Survey Telescope in support of human exploration, solar system science, and planetary defense." Session 3 - P. Michel, 2011, "Physical properties of Near-Earth Objects that inform mitigation." - A. Mainzer, J. Bauer, T. Grav, et al., 2011, "NEOWISE – an infrared view of NEOs and the solar system." - L. Benner, L.A.M. Benner, 2011, "Radar tracking and Near-Earth Object characteristics." - A. Milani, F. Bernardi, D. Farnocchia, G.B. Valsecchi, 2011, "1999 RQ36 impact risk and modeling the long-term Yarkovsky effect." - S. Chesley, 2011, "Asteroid impact hazard assessment over long time intervals."

	Session 4 - G. Longo, L. Gasperini, E. Bonatti, et al., 2011, "Consequences of the Tunguska impact and their interpretation." - M.O. Mueller, 2011, "Creating awareness – the impact hazard in public education. Curricula content, students' interests and concepts and educational implementation." - M. Boslough, 2011, "Airburst warning and response." - G.R. Gisler, 2011, "Calculation of the impact of a small asteroid on a continental shelf." - D. Isvoranu, S. Danaila, V. Badescu, 2011, "Dynamics of tsunamis generated by asteroid impact in the Black Sea." - L. Ferrier, J.-L. Véran, J.-M. Moschetta, et al., 2011, "The protective role of the Earth's atmosphere against the threat of asteroids." Session 5 - J.T. Grundmann, S. Mottola, M. Drentschew, et al., 2011, "AsteroidSquads/iSSB – a synergetic NEO deflection campaign and mitigation effects test mission scenario." - A. Zimmer, E. Messerschmid, 2011, "Target selection and mission analysis of human exploration missions to near-earth asteroids." - Y. Sugimoto, G. Radice, J.P. Sanchez, 2011, "Effects of NEO composition on deflection methodologies." - C. Foster, J. Bellerose, D. Mauro, J. Belgacem, 2011, "Mission concepts and operations for asteroid mitigation involving multiple Gravity Tractors." - N. Melamed, 2011, "Development of a handbook and an on-line tool on defending Earth against potentially hazardous objects." - A. Galvez, I. Carnelli, 2011, "ESA asteroid mission studies: what have we learnt?" - S. Wagner, B. Wie, 2011, "Robotic and human exploration/deflection mission design for asteroid 99942 Apophis." - X. Zhang, C. Granier, E. Ball, L. Kochmanski, S.D. Howe, 2011, "Near Earth Object interception using nuclear thermal rocket propulsion." Session 6 - K. Housen, K.A. Holsapple, 2011, "Measuring the momentum transfer for asteroid deflections." - O. Golubov, Y.N. Krugly, 2011, "Influence of intermediate-scale structures on Yarkovsky and YORP effect." - A. Klesh, T. Yoshimitsu, T. Kubota, 2011, "Improved navigation techniques for asteroid landers and impactors." - J. Gil-Fernandez, R. Cadenas, T. Prieto, D. Escorial, 2011, "Design options for NEO missions." - C.S. Plesko, R.P. Weaver, W.F. Huebner, 2011, "Numerical models of hazard mitigation by nuclear stand-off burst." - M. Bruck, D.S.P. Dearborn, 2011, "Limits on the use of nuclear explosives for asteroid deflection." - B. Wie, 2011, "Hypervelocity nuclear interceptors for asteroid deflection or disruption."

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2011, May 20	D. Bodewits, M. S. Kelley, J.-Y. Li, et al., 2011, <i>Astrophysical Journal Letters</i>, 733, L3, "Collisional excavation of asteroid (596 Scheila". Main-belt asteroid collision. See: http://adsabs.harvard.edu/abs/2011ApJ...733L...3B See also: http://www.nasa.gov/topics/universe/features/asteroid-collision.html http://svs.gsfc.nasa.gov/vis/a010000/a010700/a010747/
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2011, Jun 9-10	ESA Workshop Scientific and technological aspects of a sample return mission to a Near Earth Asteroid: the ESA Cosmic Vision M3 mission MarcoPolo-R, ESA-ESRIN, Frascati (Italy). MarcoPolo-R is a sample return mission to a NEA, selected by ESA as part of its Cosmic Vision M3 programme for an assessment study with launch in 2020-2022. See: http://www.oa-roma.inaf.it/MarcoPolo-R/MarcoPolo-R/Home.html
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	passed Earth at a nominal miss distance of 4.64 LD. Minimum miss distance 4.64 LD. See: 2011 LT17 - JPL , 2011 LT17 - SSA See also: 16 Jun 2155, 16 Dec 2156.
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2011, Jul	C.W. Hergenrother, R.J. Whiteley, 2011, <i>Icarus</i> , 214, 194, "A survey of small fast rotating asteroids among the near-Earth asteroid population." See: http://adsabs.harvard.edu/abs/2011Icar..214..194H
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2011 Jul	C. Magri, E.S. Howell, M.C. Nolan, et al, 2011, <i>Icarus</i> , 214, 210, "Radar and photometric observations and shape modeling of contact binary near-Earth asteroid (8567) 1996 HW1." See: http://adsabs.harvard.edu/abs/2011Icar..214..210M
2011, Jul	O. Vaduvescu, A. Tudorica, M. Birlan, et al., 2011, <i>Astronomische Nachrichten</i> , 332, 580, "Mining the CFHT Legacy Survey for known Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2011AN....332..580V
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2011, Jul 11	Anton M.J. (Tom) Gehrels (1925 - 2011, Netherlands/USA), founder of the Spacewatch project, passed away. See: http://uanews.org/node/40649 http://www.skyandtelescope.com/news/125432648.html http://azstarnet.com/news/local/govt-and-politics/article_1702e3a9-fc0c-50f0-adf1-f84c5b0abf3b.html http://www.lpl.arizona.edu/people/faculty/gehrels2.html http://www.nature.com/news/2008/080625/full/4531164a.html http://adsabs.harvard.edu/abs/1988gsaa.book.....G http://uanews.org/node/16265 http://www.lpl.arizona.edu/calendar/calendar.php?ID=457 http://en.wikipedia.org/wiki/Tom_Gehrels See also: 1980, Spacewatch program.
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2011, Jul 16	NASA spacecraft Dawn, launched 27 September 2007, with German (DLR, MPS) and Italian (ASI-INAF) instrumentation, reached main-belt asteroid 4 Vesta ($H = 3.20$ mag, $D = 530$ km) and will orbit it at an altitude of 650 - 200 km for one year, to map 80 % of the asteroid's surface. Departure from Vesta on 5 September 2012 with destination dwarf planet (former main-belt asteroid) 1 Ceres ($H = 3.34$ mag, $D = 952$ km), arriving on 6 March 2015. See: http://www.nasa.gov/mission_pages/dawn/main/index.html Ref: - C.T. Russell, C.A. Raymond, A. Coradini, et al., 11 May 2012, <i>Science</i>, 336, 684, "Dawn at Vesta: testing the protoplanetary paradigm." See: http://adsabs.harvard.edu/abs/2012Sci...336..684R - R. Jaumann, D.A. Williams, D.L. Buczowski, et al., 11 May 2012, <i>Science</i>, 336, 687, "Vesta's shape and morphology." See: http://adsabs.harvard.edu/abs/2012Sci...336..687J - S. Marchi, H.Y. McSween, D.P. O'Brien, et al., 11 May 2012, <i>Science</i>, 336, 690, "The violent collisional history of asteroid 4 Vesta." See: http://adsabs.harvard.edu/abs/2012Sci...336..690M - P. Schenk, D.P. O'Brien, S. Marchi, et al., 2012, <i>Science</i>, 336, 694, "The geologically recent giant impact basins at Vesta's South Pole." See: http://www.sciencemag.org/content/336/6082/694.full - M.C. De Sanctis, E. Ammannito, M.T. Capria, et al., 11 May 2012, <i>Science</i>, 336, 697, "Spectroscopic characterization of mineralogy and its diversity across Vesta."

	See: http://adsabs.harvard.edu/abs/2012Sci...336..697D - V. Reddy, A. Nathues, L. Le Corre, et al., 11 May 2012, <i>Science</i>, 336, 700, "Color and albedo heterogeneity of Vesta from Dawn." See: http://adsabs.harvard.edu/abs/2012Sci...336..700R - C.T. Russell, C.A. Raymond, R. Jaumann, et al., November 2013, <i>Meteoritics & Planetary Science</i>, 48, 2076, "Dawn completes its mission at 4 Vesta." See: http://adsabs.harvard.edu/doi/10.1111/maps.12091 See also: https://en.wikipedia.org/wiki/Dawn_(spacecraft)
2011, Jul 18	Morocco Fireball seen 18 July 2011 over Tata (Morocco). The fireball yields rare Mars meteorites. See: http://blogs.nature.com/news/2012/01/morocco-fireball-yields-rare-mars-meteorite.html http://www.space.com/14268-rare-mars-meteorite-rocks-tissint.html http://www.space.com/20426-mercury-meteorite-discovery-messenger.html http://www.space.com/20547-mercury-meteorite-mystery-age.html
2011, Jul 22	K. Beatty, 2011, <i>Sky & Telescope</i>, 22 July 2011, "Massive meteorite found in China." A massive space rock – one that could rank as one of the largest meteorites ever recovered – has been found in the Altai Mountains of Xinjiang Uygur province in northwest China, at an altitude of 2900 m. The large brown iron-nickel meteorite juts out from beneath a larger granite slab and the portion above ground measures about 2.3 m long and half as wide. The meteorite's mass could range between 25 to 30 tons, which would make it one of the largest meteorites known. If so, this space rock would surpass the current largest one in China, a 28-ton meteorite that was discovered in 1898 in the same region. See: http://www.skyandtelescope.com/news/126009563.html See also: http://www.space.com/12416-giant-meteorite-china-discovery.html
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2011, Jul 28	M. Connors, P. Wiegert, C. Veillet, 28 July 2011, <i>Nature</i>, 475, 481, "Earth's Trojan asteroid". See: http://adsabs.harvard.edu/abs/2011Natur.475..481C During NASA's WISE mission the first "Trojan" asteroid sharing Earth's orbit: 2010 TK7 (NEA, $H = 20.6$ mag, $D \approx 300$ m) was discovered, liberating around the leading Lagrange triangular point, L4.

	Its orbit is stable over at least ten thousand years. See also: http://blogs.nature.com/news/2011/07/astronomers_spot_earths_first.html http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-230 http://www.nasa.gov/multimedia/videogallery/index.html?media_id=103550791 http://neo.jpl.nasa.gov/news/news173.html http://www.space.com/12443-earth-asteroid-companion-discovered-2010-tk7.html http://www.time.com/time/health/article/0,8599,2085982,00.html http://www.floridatoday.com/article/20121130/COLUMNISTS0404/311300013/Stargazing-Asteroid-s-near-Earth-encounter-just-days-away https://astronomynow.com/2017/02/01/nasas-osiris-rex-probe-moonlights-as-asteroid-sleuth/ Ref.: - M.G. Connors, P. Wiegert, C. Veillet, 2011, in: American Geophysical Union, Fall Meeting 2011, abstract #P23C-1727, "Discovery of an Earth Trojan Asteroid." See: http://adsabs.harvard.edu/abs/2011AGUFM.P23C1727C - R. Dvorak, C. Lhotka, L. Zhou, May 2012, <i>Astronomy & Astrophysics</i>, 541, 127, "The orbit of 2010 TK7. Possible regions of stability for other Earth Trojan asteroids." See: http://adsabs.harvard.edu/abs/2012A%26A...541A.127D
2011, Jul 28	Apollo NEA 2011 OD18 ($H = 26.4$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [2011-20] See: 2011 OD18 - SSA , 2011 OD18 - JPL
2011, Aug	J.M. Houtkooper, 2011, <i>Planetary and Space Science</i>, 59, 1107, "Glaciopanspermia: Seeding the terrestrial planets with life?" See: http://adsabs.harvard.edu/abs/2011P%26SS...59.1107H
2011, Aug	L.B.S. Pham, Ö. Karatekin, V. Dehant, 2011, <i>Planetary and Space Science</i>, 59, 1087, "Effects of impacts on the atmospheric evolution: comparison between Mars, Earth, and Venus." See: http://adsabs.harvard.edu/abs/2011P%26SS...59.1087P
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2011, Aug 8-12	74th Annual Meeting of the Meteoritical Society, London (UK), 8-12 August 2011. See: http://www.lpi.usra.edu/meetings/metsoc2011/

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2011, Aug 23	M.P. Callahan, K.E. Smith, H.J. Cleaves, et al., 2011, <i>Proc. National Academy of Sciences of the U.S.A.</i>, 108, 13995, "Carbonaceous meteorites contain a wide range of extraterrestrial nucleobases." See: http://www.pnas.org/content/108/34/13995.full.pdf+html?sid=ebf88fed-799c-46cc-925f-93bf24de94fc See also: http://www.gl.ciw.edu/news/did_life_on_earth_get_its_start_from_meteorites
2011, Aug 24	H.-X. Baoyin, Y. Chen, J.-F. Li, 2011, <i>Research in Astronomy and Astrophysics</i> (Chinese Journal of Astronomy and Astrophysics), 10, 587, "Capturing Near Earth Objects." See: http://adsabs.harvard.edu/abs/2010RAA....10..587B See also: http://www.technologyreview.com/blog/arxiv/27112/
2011, Aug 25	Cusco Fireball Meteor sighted over Cusco (Peru), 25 August 2011. See: http://www.youtube.com/watch?v=rdQLQmoHuJk
2011, Aug 25-26	Mission Planning and Operations Group (MPOG) preparation Workshop on international recommendations of Near-Earth Object threat mitigation, organized by COPUOS STsC Action Team 14, jointly with the Association of Space Explorers (ASE), the Secure World Foundation (SWF), and hosted by NASA in Pasadena (CA,

	USA), 25-26 August 2011. Follow-up of workshop held at ESA/ESOC, Darmstadt (Germany), 27-29 October 2010. The MPOG will be part of the decision structure for an imminent impact threat, as proposed by the ASE and adopted by UN COPUOS's Action Team 14. See: http://swfound.org/events/2011/workshop-on-international-recommendations-for-neo-threat-mitigation http://www.newswise.com/articles/view/580097/?sc=dwtr&xy=5028369
2011, Aug 25-26	Fifth NASA Small Bodies Assessment Group meeting, 25-26 August 2011. Pasadena (CA, USA). See: http://www.lpi.usra.edu/sbag/meetings/ http://www.cvent.com/events/5th-meeting-of-the-nasa-small-bodies-assessment-group/event-summary-47d7c1cecd5841878eb6ca7b07554dfc.aspx http://www.lpi.usra.edu/sbag/meetings/aug2011/agenda.shtml Findings: https://www.lpi.usra.edu/sbag/findings/ Presentations: - J. Nuth, 2011, "SBAG roadmap. Science issues." See: http://www.lpi.usra.edu/sbag/meetings/aug2011/presentations/1030_Nuth_SBAG5.pdf - M. Zolensky, P. Weissman, 2011, "Sample return roadmap." See: http://www.lpi.usra.edu/sbag/meetings/aug2011/presentations/1100_Sykes_SBAG5.pdf - Y. Fernandez, 2011, "Roadmap: population identification characterization." See: http://www.lpi.usra.edu/sbag/meetings/aug2011/presentations/1430_Fernandez_SBAG5.pdf - J. Green, L. Johnson, 2011, "Planetary Science Division activities with small bodies." See: http://www.lpi.usra.edu/sbag/meetings/aug2011/presentations/Green_LNJ.pdf - P. Abell, 2011, "Roadmap for human exploration of small bodies." See: http://www.lpi.usra.edu/sbag/meetings/aug2011/presentations/1450_Abell_SBAG5.pdf
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2011, Aug 26	A.N. Krot, 2011, <i>Science</i>, 333, 1098, "Bringing part of an asteroid back home." See: http://adsabs.harvard.edu/abs/2011Sci...333.1098K See also: http://www.nature.com/news/2011/110825/full/news.2011.506.html http://physicsworld.com/cws/article/news/46981

2011, Aug 26	T. Nakamura, T. Noguchi, M. Tanaka, et al., 2011, <i>Science</i> , 333, 1113, " Itokawa dust particles: a direct link between S-type asteroids and ordinary chondrites." See: http://adsabs.harvard.edu/abs/2011Sci...333.1113N
2011, Aug 26	H. Yurimoto, K. Abe, M. Abe, et al., 2011, <i>Science</i> , 333, 1116, "Oxygen isotopic compositions of asteroidal materials returned from Itokawa by the Hayabusa mission." See: http://adsabs.harvard.edu/abs/2011Sci...333.1116Y
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2011, Aug 26	A. Tsuchiyama, M. Uesugi, T. Matsushima, et al., 2011, <i>Science</i> , 333, 1125, "Three-dimensional structure of Hayabusa samples: origin and evolution of Itokawa regolith." See: http://adsabs.harvard.edu/abs/2011Sci...333.1121N
2011, Aug 26	K. Nagao, R. Okazaki, T. Nakamura, et al., 2011, <i>Science</i> , 333, 1128, "Irradiation history of Itokawa regolith material deduced from noble gases in the Hayabusa samples." See: http://adsabs.harvard.edu/abs/2011Sci...333.1128N
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2011, Sep	F. Moreno, J. Licandro, J.L. Ortiz, et al., 2011, <i>Astrophysical Journal</i> , 738, 130, "(596) Scheila in outburst: a probable collision event in the main asteroid belt." See: http://adsabs.harvard.edu/abs/2011ApJ...738..130M

2011, Sep	C.A. Thomas, D.E. Trilling, J.P. Emery, et al., 2011, <i>Astronomical Journal</i> , 142, 85, "ExploreNEOs. V. Average albedo by taxonomic complex in the Near-Earth Asteroid population." See: http://adsabs.harvard.edu/abs/2011AJ....142...85T
2011, Sep	J. Yang, J.I. Goldstein, E.R.D. Scott, et al., 2011, <i>Meteoritics & Planetary Science</i> , 46, 1227, "Thermal and impact histories of reheated group IVA, IVB, and ungrouped iron meteorites and their parent asteroids." See: http://adsabs.harvard.edu/abs/2011M%26PS...46.1227Y
2011, Sep 1	Starting from 1 September 2011 NEODyS (see item 1999, March 5-6) is sponsored by ESA, which pays a portion of the operating costs, both for the background orbit and risk computations and for the database and web interface; the rest of the cost is covered, as before, by the Department of Mathematics, University of Pisa, with the running research grants of the Celestial Mechanics Group, and by IASF-INAF (Rome), with a PRIN-INAF grant.
2011, Sep 6	The Space Generation Advisory Council (SGAC) announced the winner of the 2011 <i>Move an Asteroid Competition</i> , Alison Gibbings (UK). See: http://spacegeneration.org/index.php/eventstopics/news/454-sgac-announces-the-winner-of-the-2011-move-an-asteroid-competition http://spacegeneration.org/images/stories/Projects/NEO/MAA/a_smart_cloud_approach_to_asteroid_deflection.pdf
2011, Sep 8	M. Willbold, T. Elliott, S. Moorbath, 2011, <i>Nature</i> , 477,195, "The tungsten isotopic composition of the Earth's mantle before the terminal bombardment." See: http://adsabs.harvard.edu/abs/2011Natur.477..195W http://www.nature.com/nature/journal/v477/n7363/full/nature10399.html
2011, Sep 15	Meteor fireball over Southern California, Arizona and Nevada (USA). See: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-291 http://www.amsmeteors.org/2011/09/major-fireball-event-seen-from-southern-california-arizona-and-nevada-september-14th-2011-945-pdt/ http://latimesblogs.latimes.com/lanow/2011/09/meteor-reports-across-sky.html http://www.irishweatheronline.com/news/space/meteorite/meteorite-hunt-begins-after-thousands-witness-southwestern-us-fireball/37884.html
2011, Sep 15-18	International Meteor Conference 2011 , 30th edition, 15-18 September, Sibiu (Romania),

	See: http://www.imo.net/imc2011/index.php
2011, Sep 16	Memorial seminar Tom Gehrels 1925-2011: A Celebration of Life , Lunar and Planetary Laboratory, Kuiper Space Sciences, Rm 308, Tucson (AZ, USA), 16 September 2011, 3:00 - 5:00 p.m.. See: http://www.lpl.arizona.edu/calendar/calendar.php?ID=457
2011, Sep 27	Apollo NEA 2011 SE58 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2011-21] See: 2011 SE58 - SSA , 2011 SE58 - JPL See also: http://www.space.com/13145-2-small-asteroids-pass-earth-moon.html
2011, Sep 27-30	Keck Institute for Space Studies (KISS) Workshop - Asteroid Retrieval Mission Study , California Institute of Technology, Pasadena (CA, USA), 27-30 September 2011. See: http://kiss.caltech.edu/workshops/asteroid2011/index.html http://www.wired.com/wiredscience/2011/10/asteroid-moving/ http://www.space.com/13164-killer-asteroids-deflection-humanity-cooperation.html http://billionyearplan.blogspot.com/2011/10/to-deflect-killer-asteroids-humanity.html http://www.newscientist.com/article/dn23039-nasa-mulls-plan-to-drag-asteroid-into-moons-orbit.html http://www.space.com/19151-asteroid-moon-orbit-nasa-study.html Study final report (2 April 2012): http://kiss.caltech.edu/study/asteroid/asteroid_final_report.pdf Other presentations: - J. Brophy, F. Culick, L. Friedman, et al., March 14, 2012, "Asteroid retrieval feasibility." See: http://kiss.caltech.edu/study/asteroid/20120314_ESA_ESTEC.pdf - J.R. Brophy, L. Friedman, F. Culick, et al., March 7, 2012, "Asteroid retrieval mission feasibility study." See: http://kiss.caltech.edu/study/asteroid/20120307_IEEE_Presentation.pdf - J.R. Brophy, L. Friedman, F. Culick, July 9, 2012, "Asteroid retrieval mission feasibility study." See: http://www.lpi.usra.edu/sbag/meetings/jul2012/presentations/TUES_1645_Brophy_Asteroid_Return.pdf See also: http://www.space.com/19151-asteroid-moon-orbit-nasa-study.html http://www.space.com/20538-nasa-asteroid-capture-funding.html http://www.space.com/20552-nasa-considers-plan-to-lasso-an-asteroid-for-study-video.html http://www.space.com/20591-nasa-asteroid-capture-mission-feasibility.html http://www.nasa.gov/news/budget/index.html http://www.space.com/20599-nasa-2014-budget-highlights.html

	http://www.space.com/20601-animation-of-proposed-asteroid-retrieval-mission-video.html http://www.thespacereview.com/article/2283/1 http://targetneo.jhuapl.edu http://www.nasa.gov/content/new-imagery-of-asteroid-mission/#.UkNbdX-TLpe http://www.nasa.gov/content/asteroid-initiative-idea-synthesis-workshop/#.UkPgqn-TLpc
2011, Sep 28	Aten NEA 2011 TO ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.33 LD. Minimum miss distance 0.33 LD. [2011-22] See: 2011 TO - SSA , 2011 TO - JPL See also: 28 Sep 1980, 27 Sep 2044.
2011, Sep 28-29	First NEA detected by the Teide Observatory Tenerife Asteroid Survey (TOTAS) during an observation slot sponsored by the ESA Space Situational Awareness (SSA) programme : 2011 SF108 ($H = 20.0$ mag, $D = 350$ m). See: http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2011+SF108&orb=1 http://www.esa.int/SPECIALS/SSA/SEMURW6UXSG_0.html See also: http://www.space.com/13272-asteroid-discovery-amateur-astronomers-2011-sf108.html http://www.dailymail.co.uk/sciencetech/article-2048797/Amateur-skywatchers-Tenerife-impact-threat-asteroid.html
2011, Sep 29	Observations by NASA's Wide-field Infrared Survey Explorer (WISE), in a survey program called NEOWISE, show that there are significantly fewer near-Earth asteroids in the mid-size range than previously thought. The findings also indicate that the Spaceguard program has found 911 NEAs, 93% of the estimated 981 ± 19 NEAs larger than 1000 m, meeting the 90% goal agreed to with U.S. Congress in 1998. For smaller objects the NEOWISE detection census reads: ~1,200 (80%) of the estimated ~1,500 NEAs in the 500-1000 m range; ~1,100 (46%) of the estimated ~2,400 NEAs in the 300-500 m range; ~2,000 (13%) of the estimated ~15,700 NEAs in the 100-300 m range. The estimated number of NEAs with $D > 140$ m is $13,200 \pm 1,900$. The estimated number of NEAs with $D > 100$ m is $20,500 \pm 3,000$. Ref: - A. Mainzer, T. Grav, J. Bauer, et al., 2011, <i>Astrophysical Journal</i>, 743, 156, "NEOWISE observations of Near-Earth Objects: preliminary results." See: http://adsabs.harvard.edu/abs/2011ApJ...743..156M - A. Mainzer, T. Grav, J. Masiero, et al., June 2012, <i>Astrophysical Journal</i>, 752, 110, "Characterizing subpopulations within the Near Earth Objects with NEOWISE: preliminary results." See:

	http://adsabs.harvard.edu/abs/2012ApJ...752..110M See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-304 http://www.jpl.nasa.gov/video/index.cfm?id=1023 http://apod.nasa.gov/apod/ap111001.html http://www.space.com/13132-potentially-killer-asteroids-earth-nasa.html http://www.space.com/13129-killer-asteroids-wise.html
2011, Sep 30	Apollo NEA 2011 SM173 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.76 LD. Minimum miss distance 0.75 LD. [2011-23] See: 2011 SM173 - SSA , 2011 SM173 - JPL See also: http://www.space.com/13145-2-small-asteroids-pass-earth-moon.html
2011, Oct	G. Beekman, 2011, <i>Zenit</i> , oktober 2011, "Vier trouwe begeleiders van de aarde." See: http://www.dekoepel.nl/zenit/
2011, Oct	G.C. de Elía, R.P. Di Sisto, 2011, <i>Astronomy & Astrophysics</i> , 534, A129, "Impactor flux and cratering on Ceres and Vesta : implications for the early Solar System." See: http://adsabs.harvard.edu/abs/2011A%26A...534A.129D
2011, Oct	M. Elvis, J. McDowell, J.A. Hoffman, R.P. Binzel, 2011, <i>Planetary and Space Science</i> , 59, 1408, "Ultra-low delta-v objects and the human exploration of asteroids." See: http://adsabs.harvard.edu/abs/2011P%26SS...59.1408E
2011, Oct	D.H. Forgan, E. Martin, 2011, <i>International Journal of Astrobiology</i> , 10, 307, "Extrasolar asteroid mining as forensic evidence for extraterrestrial intelligence." See: http://adsabs.harvard.edu/abs/2011IJAsB..10..307F
2011, Oct	S.-P. Gong, J.-F. Li, X.-Y. Zeng, 2011, <i>Research in Astronomy and Astrophysics</i> , 11, 1123, "Utilization of H-reversal trajectory of solar sail for asteroid deflection." See: http://adsabs.harvard.edu/abs/2011RAA....11.1123G See also: http://www.asianscientist.com/topnews/tsinghua-university-spacecraft-solar-sail-asteroid-apophis-earth-2036/ http://www.space.com/12645-asteroid-deflection-doomsday-earth-capability.html http://www.space.com/12781-space-missions-deflect-dangerous-asteroids-apophis.html
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2011, Oct	G. Pratesi, V.M. Cecchi, 2011, <i>Atlas of Meteorites</i> (Cambridge: CUP). See: http://www.cambridge.org/aus/catalogue/catalogue.asp?isbn=9780521840354
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2011, Oct	O. Vaduvescu, M. Birlan, A. Tudorica, et al., 2011, <i>Planetary and Space Science</i>, 59, 1632, "EURONEAR – recovery, follow-up and discovery of NEAs and MBAs using large field 1-2m telescopes." See: http://adsabs.harvard.edu/abs/2011P%26SS...59.1632V
2011, Oct	S.D. Wolters, A.J. Ball, N. Wells, et al., 2011, <i>Earth and Planetary Astrophysics</i>, 59, 1506, "Measurement requirements for a near-Earth asteroid impact mitigation demonstration mission." See: http://adsabs.harvard.edu/abs/2011P%26SS...59.1506W See also: http://www.technologyreview.com/blog/arxiv/27028/
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	population of large NEAs: a global view." See: http://adsabs.harvard.edu/abs/2011epsc.conf..402V - R. Wainscoat, R. Jedicke, L. Denneau, et al., 2011, p.714, "The Pan-STARRS search for Near Earth Asteroids: present status and future plans." See: http://adsabs.harvard.edu/abs/2011epsc.conf..714W
2011, Oct 8	Draconid meteor shower, left-overs from the tail of comet Giacobini-Zinner, observed from ESA Falcon-20 research airplanes. See: http://www.esa.int/esaSC/SEM8DPGURTG_index_0.html
2011, Oct 11	I. Halevy, W.W. Fischer, J.M. Eiler, 2011, <i>Proc. National Academy of Sciences</i>, 108, 16895, "Carbonates in the Martian meteorite Allan Hills 84001 formed at 18 ± 4 °C in a near-surface aqueous environment." See: http://www.pnas.org/content/108/41/16895.abstract
2011, Oct 12	Apollo NEA 2011 UT ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.59 LD. [2011-24] See: 2011 UT - SSA , 2011 UT - JPL
2011, Oct 13	Closest approach of Amor NEA 1036 Ganymed (A924 UB, $H = 9.6$ mag, $D \approx 36.49$ km), largest NEA known, in the period 1900-2100 yr, at a distance of 0.36 AU ≈ 140 LD. See: 1036 Ganymed - SSA, 1924 TD - JPL Ref: J. Meeus, M. Drummen, September 2011, <i>Zenit</i>, "Ganymed in aantocht." See: http://www.dekoepel.nl/zenit/september2011.html See also: http://en.wikipedia.org/wiki/1036_Ganymed See also: 13 Oct 2024.
2011, Oct 15	G.R. Osinski, L.L. Tornabene, R.A.F. Grieve, 2011, <i>Earth and Planetary Science Letters</i>, 310, 167, "Impact ejecta emplacement on terrestrial planets." See: http://adsabs.harvard.edu/abs/2011E%26PSL.310..167O
2011, Oct 17	Apollo NEA 2009 TM8 ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.46 LD. [2011-25] See: 2009 TM8 - SSA , 2009 TM8 - JPL See also: 17 Oct 2009.
2011, Oct 26	Apollo NEA 2011 UL169 ($H = 28.3$ mag, $D \approx 9$ m) passed Earth at a

	nominal miss distance of 0.69 LD. Minimum miss distance 0.69 LD. [2011-26] See: 2011 UL169 - SSA , 2011 UL169 - JPL
2011, Oct 28	Apollo NEA 2011 UX255 ($H = 27.4$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.36 LD. Minimum miss distance 0.36 LD. [2011-27] See: 2011 UX255 - SSA , 2011 UX255 - JPL
2011, Oct 28	H. Sierks, P. Lamy, C. Barbieri, et al., 2011, <i>Science</i> , 334, 487, "Images of asteroid 21 Lutetia : a remnant planetesimal from the early Solar System." See: http://adsabs.harvard.edu/abs/2011Sci...334..487S
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2011, Nov	M. Brozović, L.A.M. Benner, P.A. Taylor, et al., 2011, <i>Icarus</i> , 216, 241, "Radar and optical observations and physical modeling of triple near-Earth Asteroid (136617) 1994 CC ." See: http://adsabs.harvard.edu/abs/2011Icar..216..241B
2011, Nov	M. Hicks, J. Somers, T. Truong, et al., 2011, <i>The Astronomer's Telegram</i> , #3763, "Broadband photometry of 2005 YU55 : Solar phase behavior and absolute magnitude." See: http://adsabs.harvard.edu/abs/2011ATel.3763....1H
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2011, Nov	J.R. Masiero, A.K. Mainzer, T. Grav, et al., 2011, <i>Astrophysical Journal</i> , 741, 68, "Main belt asteroids with WISE/NEOWISE . I. Preliminary albedos and diameters." See: http://adsabs.harvard.edu/abs/2011ApJ...741...68M See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-296
2011, Nov	M. Popescu, M. Birlan, R. Binzel, et al., 2011, <i>Astronomy & Astrophysics</i> , 535, A15, "Spectral properties of eight near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2011A%26A...535A..15P
2011, Nov 8	Apollo NEA 308635 (2005 YU55 , $H = 21.6$ mag, $D = 360$ m, $P_0 =$

	1.22 yr, PHA) passed Earth at a nominal miss distance of 0.845 LD (= 51.0 R_{Earth} from the geocenter) and the Moon at a nominal miss distance of 0.624 LD. Minimum miss distance 0.845 LD. Arecibo Observatory radar imaging on 19 April 2010 reduced uncertainties about its orbit by 50%, eliminating any possibility of an impact with the Earth for the next 100 years. New Arecibo Observatory and Goldstone radar observations on 7 and 8 November 2011 confirmed a spherical shape. On 19 January 2029, asteroid 2005 YU55 will pass Venus at a nominal distance of 0.74 LD; minimum miss distance 0.66 LD. See: 308635 2005 YU55 - SSA , 2005 YU55 - JPL [2011-28] Ref: - M. Hicks, K. Lawrence, L. Benner, 2010, <i>The Astronomer's Telegram</i>, #2571, "Palomar spectroscopy of 2001 FM129, 2004 FG11, and 2005 YU55." - See: http://adsabs.harvard.edu/abs/2010ATel.2571....1H - M. Hicks, J. Somers, T. Truong, et al., 2011, <i>The Astronomer's Telegram</i>, #3763, "Broadband photometry of 2005 YU55: Solar phase behavior and absolute magnitude." - See: http://adsabs.harvard.edu/abs/2011ATel.3763....1H - P.A. Taylor, M.C. Nolan, E.S. Howell, et al., 2011, <i>Bulletin American Astronomical Society</i>, AAS Meeting #219, #432.11, "Radar observations of 2005 YU55's flyby of Earth." - See: http://adsabs.harvard.edu/abs/2012AAS...21943211T - N.A. Moskovitz, B. Yang, L.F. Lim, et al., 2012, in: <i>43rd Lunar and Planetary Science Conference</i>, 19-23 March 2012, The Woodlands (TX, USA), <i>LPI Contribution No.</i> 1659, p.2080, "The near-Earth encounter of asteroid 2005 YU55: visible and near-infrared spectroscopy." - See: http://adsabs.harvard.edu/abs/2012LPI....43.2080M - L.F. Lim, J.P. Emery, N.A. Moskovitz, M. Granvik, 2012, in: <i>43rd Lunar and Planetary Science Conference</i>, 19-23 March 2012, The Woodlands (TX, USA), <i>LPI Contribution No.</i> 1659, id.2202, "The near-Earth encounter of 2005 YU55: thermal infrared observations from Gemini North." - See: http://adsabs.harvard.edu/abs/2012LPI....43.2202L - B.D. Warner, R.D. Stephens, J.W. Brinsfield, et al., 2012, <i>Minor Planet Bulletin</i>, 39, 84, "Lightcurve analysis of NEA 2005 YU55." - See: http://adsabs.harvard.edu/abs/2012MPBu...39...84W - L.F. Lim, J.P. Emery, N.A. Moskovitz, et al., October 2012, <i>American Astronomical Society</i>, DPS meeting #44, #305.01, "The Near-Earth encounter of asteroid 308635 (2005 YU55): thermal IR observations." - See: http://adsabs.harvard.edu/abs/2012DPS....4430501L - T. G. Mueller, T. Miyata, C. Kiss, M. A. Gurwell, et al., Oct 2013, <i>Astronomy & Astrophysics</i>, 558, 97, "Physical properties of asteroid (308635) 2005 YU55 derived from multi-instrument infrared

	observations during a very close Earth-approach." See: http://www.aanda.org/articles/aa/abs/2013/10/aa21664-13/aa21664-13.html See also: http://www.jpl.nasa.gov/news/news.cfm?release=2010-144 http://www.nasa.gov/topics/solarsystem/features/asteroid20100429.html http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2005%20YU55%20;orb=1;cov=0;log=0;cad=1#cad http://www.news.cornell.edu/stories/April10/AreciboAsteroid.html http://www.space.com/8312-potentially-dangerous-asteroid-spotted-passing-earth.html http://www.space.com/11310-huge-asteroid-2005-yu55-passing-earth-november.html http://www.sciencedaily.com/releases/2010/05/100503010702.htm http://www.planetary.org/blog/article/00002463/ http://neo.jpl.nasa.gov/news/news171.html http://www.nature.com/news/2011/111102/full/news.2011.625.html http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-129 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-332 http://www.ustream.tv/recorded/18250783 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-343 http://herschel.cf.ac.uk/news/herschel-observe-near-earth-asteroid http://www.huffingtonpost.com/2011/11/08/asteroid-earth-2011-november-yu55_n_1081710.html?ref=green http://www.youtube.com/watch?v=R-ZVqiN3OBE http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-346 http://www.space.com/13549-huge-asteroid-2005yu55-close-earth-flyby.html http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2011-351 http://www.cbc.ca/news/world/story/2011/11/09/asteroid-research.html http://www.mpe.mpg.de/News/20111116/text.html http://apod.nasa.gov/apod/ap111109.html http://en.wikipedia.org/wiki/2005_YU55 http://en.wikipedia.org/wiki/File:2005-YU55-Trajectory-8th-Nov-2011.png See also: 8 Nov 2075.
2011, Nov 13-20	<i>The Second Arab Impact Cratering and Astrogeological Conference (AICAC II)</i>, 13-20 November 2011, Casablanca (Morocco). See: http://www.fsac.ac.ma/aicaii/index.html
2011, Nov 14-15	<i>Near Earth Objects (NEOs) Working Group on Media Communications and Risk Management</i>, 14-15 November 2011, Laboratory for Atmospheric and Space Physics (LASP), University of Colorado, Boulder (CO, USA). Co-sponsored by Secure World Foundation and the Association of Space Explorers. See: http://swfound.org/events/2011/near-earth-objects-mediारisk-communications-working-group http://www.unoosa.org/pdf/pres/stsc2012/tech-46E.pdf Report:

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2011, Nov 14-16	NASA Human Space Exploration Community Workshop on the Global Exploration Roadmap , 14-16 November 2011, San Diego (CA, USA). The workshop did frame the Global Exploration Roadmap, with overviews of NASA's plans for human spaceflight, including exploration missions to an asteroid and Mars. See: http://www.nasa.gov/exploration/about/isecg/ger-workshop.html
2011, Nov 17	Charles F. Bolden Jr., 2011, NASA Administrator, Statement before the Subcommittee on Science and Space Committee on Commerce, Science and Transportation, U. S. Senate. See: http://www.spaceref.com/news/viewsr.html?pid=39082
2011, Nov 17	EU FP7 NEOShield proposal approved and grant agreement signed by the European Commission. Overall funding is M€ 5.8, including M€ 1.8 from partners, for a project lifetime of 3.5 years. NEOShield involves 13 partner institutes in France, Germany, Russia, Spain, UK and USA, and will be coordinated by DLR in Berlin (Germany). The NEOShield project, which formally commences in 1 January 2012, covers investigation of physical properties of NEOs, mitigation methods, technology development, demonstration missions, and a global response campaign roadmap. The NEOShield kick-off meeting will be held at DLR, 16-17 January 2012. See: http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-2640/year-2012/ http://elib.dlr.de/70019/
2011, Nov 18	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) , <i>Information on research in the field of NEOs carried out by Member States, international organizations and other entities.</i> A/AC.105/C.1/100. See: http://www.oosa.unvienna.org/pdf/reports/ac105/C1/AC105_C1_100E.pdf
2011, Nov 18	Leonid Fireball over Tenerife (Canary Islands, Spain).

	See: http://apod.nasa.gov/apod/ap111122.html
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2011, Dec 7	Apollo NEA 2003 XV ($H = 26.6$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 1.06 LD. Minimum miss distance 1.06 LD. See: 2003 XV - SSA , 2003 XV - JPL
2011, Dec 9	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) , <i>Near-Earth objects, 2011-2012, Interim report of Action Team 14 on Near-Earth Objects</i> . See: http://www.unoosa.org/pdf/limited/c1/AC105_C1_L316E.pdf

2011, Dec 11	Apollo NEA 2018 XA4 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 1.68 LD. Minimum miss distance 0.57 LD. See: 2018 XA4 - SSA , 2018 XA4 - JPL See also: 11 Dec 2018 .
2011, Dec 14	Apollo NEA 2011 YQ1 ($H = 25.7$ mag, $D \approx 26$ m) passed Earth at a nominal miss distance of 1.02 LD. Minimum miss distance 1.01 LD. See: 2011 YQ1 - SSA , 2011 YQ1 - JPL
2011, Dec 15	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), Near-Earth objects, 2011-2012. Draft recommendations of the Action Team on Near-Earth Objects for an international response to the near-Earth object impact threat. See: http://www.unoosa.org/pdf/limited/c1/AC105_C1_L317E.pdf
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2011, Dec 28	Apollo NEA 2011 YC40 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2011-30] See: 2011 YC40 - SSA , 2011 YC40 - JPL
2011, Dec 29	Apollo NEA 2012 AQ ($H = 31.1$ mag, $D \approx 2.2$ m) passed Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.70 LD. [2011-31] See: 2012 AQ - SSA , 2012 AQ - JPL
2011, Dec 30	Apollo NEA 2011 YC63 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.63 LD. Minimum miss distance 0.62 LD. [2011-32] See: 2011 YC63 - SSA , 2011 YC63 - JPL
2012, Jan 1	8453 NEAs known (ranging in size up to ~37 km: 1036 Ganymed , A924 UB , $H = 9.45$ mag, $D = 36.5$ km, Amor NEA), of which 1272 PHAs (ranging in size from 140 m up to ~5 km: 4179 Toutatis , 1989 AC , $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, Apollo NEA, PHA). See: http://neo.jpl.nasa.gov/stats/
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2012, Feb 1-3	<i>Workshop on the Early Solar System Bombardment II</i> , Houston (TX, USA), 1-3 February 2012. See: http://www.lpi.usra.edu/meetings/bombardment2012/ Among the presentations: - W.F. Bottke, D. Vokrouhlicky, D. Minton, et al., 2012, <i>LPI Contribution No. 1649</i> , p.6-7, "The Great Archean Bombardment." See: http://adsabs.harvard.edu/abs/2012LPICo1649....6B - S. Goderis, J. Belza, Ph. Claesy, 2012, <i>LPI Contribution No. 1649</i> , p.26-27, "The impact cratering record for clues on the rate of collisions and provenance." See: http://adsabs.harvard.edu/abs/2012LPICo1649...26G - B.C. Johnson, H.J. Melosh, 2012, <i>LPI Contribution No. 1649</i> , p.32-33, "New estimates for the number of large impacts throughout Earth's history." See: http://adsabs.harvard.edu/abs/2012LPICo1649...32J - C. Koeberl, 2012, <i>LPI Contribution No. 1649</i> , p.40, "Search for a geochemical record of the Late Heavy Bombardment on Earth." See: http://adsabs.harvard.edu/abs/2012LPICo1649...40K - S. Marchi, W.F. Botke, D.A. Kring, A. Morbidelli, 2012, <i>LPI Contribution No. 1649</i> , p.45-46, "Two populations of early lunar impactors as recorded in its ancient crater population." See: http://adsabs.harvard.edu/abs/2012LPICo1649...45M - A. Morbidelli, S. Marchi, W.F. Bottke, 2012, <i>LPI Contribution No. 1649</i> , p.53-54, "The sawtimeline of the first billion year of lunar bombardment." See: http://adsabs.harvard.edu/abs/2012LPICo1649...53M - N. Schmedemann, T. Kneissl, G. Michael, et al., 2012, <i>LPI Contribution No. 1649</i> , p.75-76, "Crater size-frequency distributions and chronologies of asteroids." See: http://adsabs.harvard.edu/abs/2012LPICo1649...75S
2012, Feb 5	BBC Four, 5 February 2012, 00:35, "Asteroids – the Good, the Bad and the Ugly." See: http://www.bbc.co.uk/programmes/b00vv0w8

2012, Feb 13-15	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) Scientific and Technical SubCommittee, 49th session, in Vienna (Austria). WG NEO and Action Team 14 on NEOs did meet, chaired by Sergio Camacho (Mexico). Report: http://www.unoosa.org/oosa/en/COPUOS/stsc/2012/index.html http://www.oosa.unvienna.org/pdf/limited/c1/AC105_C1_L310E.pdf http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_1001E.pdf Technical presentations: - L. Johnson, 2012, "Near Earth Object Observation Program. Close approaches of 2011." See: http://www.unoosa.org/pdf/pres/stsc2012/tech-35E.pdf - J. Prado, 2012, "The case of Apophis." See: http://www.unoosa.org/pdf/pres/stsc2012/tech-36E.pdf - R.A. Williamson, 2012, "NEOs, the media, and risk communication. Report of a workshop." See: http://www.unoosa.org/pdf/pres/stsc2012/tech-46E.pdf See also: http://www.space.com/14683-big-asteroid-2011-ag5-threat-earth.html
2012, Feb 16	Aten NEA 367943 Duende (2012 DA14, $H = 24.2$ mag, $D \approx 40 \times 20$ m), discovered by the Spanish Observatorio Astronomico de la Sagra, passed Earth at a nominal miss distance of 6.78 LD. Minimum miss distance 6.78 LD. See: 367943 Duende - SSA , 2012 DA14 - JPL See also: http://www.planetary.org/blogs/guest-blogs/3418.html https://en.wikipedia.org/wiki/367943_Duende See also: 17 Feb 1918, 19 Aug 2004, 15 Feb 2013, 15 Feb 2046, 15 Feb 2087.
2012, Feb 20	Apollo NEA 2012 DY13 ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2012-04] See: 2012 DY13 - SSA , 2012 DY13 - JPL
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2012, Mar	P.B. Babadzhanyan, I.P. Williams, G.I. Kokhirova, 2012, <i>Monthly Notices Royal Astronomical Society</i>, 420, 2546, "Near-Earth object

	2004 CK39 and its associated meteor showers." See: http://adsabs.harvard.edu/abs/2012MNRAS.420.2546B
2012, Mar	P.A. Bland, P. Spurný, A.W.R. Bevan, et al., 2012, <i>Australian Journal of Earth Sciences</i>, 59, 177, "The Australian Desert Fireball Network: a new era for planetary science." See: http://adsabs.harvard.edu/abs/2012AuJES..59..177B See also: http://www3.imperial.ac.uk/desertfireballnetwork
2012, Mar	A.S. Betzler, E.P. Borges, 2012, <i>Astronomy & Astrophysics</i>, 539, 158, "Non-extensive distributions of rotation periods and diameters of asteroids." The authors argue that the number of NEAs with $D > 1$ km is 994 ± 30. See: http://adsabs.harvard.edu/abs/2012A%26A...539A.158B
2012, Mar	M. Čuk, 2012, <i>Icarus</i>, 218, 69, "Chronology and sources of lunar impact bombardment." See: http://adsabs.harvard.edu/abs/2012Icar..218..69C
2012, Mar	J. Fang, J.-L. Margot, 2012, <i>Astronomical Journal</i>, 143, 59, "The role of Kozai cycles in near-Earth binary asteroids." See: http://adsabs.harvard.edu/abs/2012AJ....143..59F
2012, Mar	M. Granvik, J. Vaubaillon, R. Jedicke, 2012, <i>Icarus</i>, 218, 262, "The population of natural Earth satellites." See: http://adsabs.harvard.edu/abs/2012Icar..218..262G See also: http://www.ifa.hawaii.edu/info/press-releases/minimoons/ http://www.space.com/15151-earth-multiple-moons-asteroids.html
2012, Mar	D. Jewitt, 2012, <i>Astronomical Journal</i>, 143, 66, "The active asteroids." See: http://adsabs.harvard.edu/abs/2012AJ....143..66J
2012, Mar 1	Oslo Meteorite. A piece of a meteorite crashed through the roof of a garden hut in the middle of Oslo (Norway). The rock weighing 585 grams, which split in two, probably detached from a meteorite observed over Norway on March 1. The meteorite was identified as a breccia, or a rock composed of broken fragments. See: http://www.newsinenglish.no/2012/03/12/meteorite-smashed-through-oslo-roof/ http://www.space.com/14893-meteorite-crash-oslo-norway.html
2012, Mar 1	Apollo NEA 2012 EZ1 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.60 LD. Minimum miss distance 0.60 LD.

	[2012-05] See: 2012 EZ1 - SSA , 2012 EZ1 - JPL
2012, Mar 7	J. Foust, 2012, <i>SpaceRef</i>, 7 March 2012, "Making the case for human missions to asteroids." See: http://www.spaceref.com/news/viewnews.html?id=1620
2012, Mar 9	G.S. Collins, 2012, <i>Science</i>, 335, 1176, "Moonstruck magnetism." See: http://www.sciencemag.org/content/335/6073/1176.summary See also: http://www.space.com/14836-asteroid-collision-moon-magnetism.html
2012, Mar 9	M.A. Wieczorek, B.P. Weiss, S.T. Stewart, 2012, <i>Science</i>, 335, 1212, "An impactor origin for lunar magnetic anomalies." See: http://www.sciencemag.org/content/335/6073/1212 See also: http://www.space.com/14836-asteroid-collision-moon-magnetism.html
2012, Mar 13	E. Nakamura, A. Makishima, T. Moriguti, et al., 2012, <i>Proc. National Academy of Sciences</i>, 109(11), E624, "Space environment of an asteroid preserved on micrograins returned by the Hayabusa spacecraft." See: http://www.pnas.org/content/109/11/E624.full.pdf+html?sid=e9c82620-acc1-4ac9-a373-aebd661fa82d See also: http://www.space.com/14691-asteroid-impacts-hayabusa-meteorite-samples.html http://adsabs.harvard.edu/abs/2012LPI....43.1375N
2012, Mar 19-23	43rd Lunar and Planetary Science Conference, 19-23 March 2012, The Woodlands (TX, USA). See: http://www.lpi.usra.edu/meetings/lpsc2012/ Among the papers: - P.A. Abell, B.W. Barbee, R.G. Mink, et al., 2012, <i>LPI Contribution</i> No. 1659, p.2842, "The Near-Earth Object Human Space Flight Accessible Targets Study (NHATS) list of Near-Earth Asteroids: identifying potential targets for future exploration." See: http://adsabs.harvard.edu/abs/2012LPI....43.2842A - M.A. Barucci, P. Michel, A. Cheng, et al., 2012, <i>LPI Contribution</i> No. 1659, p.1457, "MarcoPolo-R: Near Earth Asteroid sample return mission selected for ESA assessment study phase." See: http://adsabs.harvard.edu/abs/2012LPI....43.1457B - A. Bazso, 2012, <i>LPI Contribution</i> No. 1659, p.1809, "Lunar effects on close encounters of Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2012LPI....43.1809B - E.B. Bierhaus, L. Dones, 2012, <i>LPI Contribution</i> No. 1659, p.2451,

	"Cratering by impact ejecta, from Mercury to the asteroids." See: http://adsabs.harvard.edu/abs/2012LPI....43.2451B - R.P. Binzel, D. Polishook, F.E. DeMeo, et al., 2012, <i>LPI Contribution</i> No. 1659, p.2222, "Marco Polo-R target asteroid (175706) 1996 FG3: possible evidence for an annual thermal wave." See: http://adsabs.harvard.edu/abs/2012LPI....43.2222B - P. Brown, T. Ens, W.N. Edwards, E.A Silber, 2012, <i>LPI Contribution</i> No. 1659, p.1581, "Global detection of airbursts: a combined satellite-infrasound study." See: http://adsabs.harvard.edu/abs/2012LPI....43.1581B - M. Bruck Syal, P.H. Schultz, D.S.P. Dearborn, R.A. Managan, 2012, <i>LPI Contribution</i> No. 1659, p.2480, "Porosity controls on asteroid defense strategies." See: http://adsabs.harvard.edu/abs/2012LPI....43.2480B - T.L. Dunn, T.H. Burbine, 2012, <i>LPI Contribution</i> No. 1659, p.2305, "Mineralogies of Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2012LPI....43.2305D - C.W. Hergenrother, D.J. Scheeres, M. Nolan, et al., 2012, <i>LPI Contribution</i> No. 1659, p.2219, "Lightcurve and phase function photometry of the OSIRIS-REx target (101955) 1999 RQ36." See: http://adsabs.harvard.edu/abs/2012LPI....43.2219H - K.R. Housen, K.A. Holsapple, 2012, <i>LPI Contribution</i> No. 1659, p.2539, "Deflecting asteroids by impacts: what is Beta?" See: http://adsabs.harvard.edu/abs/2012LPI....43.2539H - D.S. Lauretta, OSIRIS-REx Team, 2012, <i>LPI Contribution</i> No. 1659, p.2491, "An overview of the OSIRIS-REx asteroid sample return mission." See: http://adsabs.harvard.edu/abs/2012LPI....43.2491L - L.F. Lim, J.P. Emery, N.A. Moskovitz, M. Granvik, 2012, <i>LPI Contribution</i> No. 1659, id.2202, "The near-Earth encounter of 2005 YU55: thermal infrared observations from Gemini North." See: http://adsabs.harvard.edu/abs/2012LPI....43.2202L - J.F. McCarthy, 2012, <i>LPI Contribution</i> No. 1659, p.1016, "A low cost approach to close-up examination of multiple Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2012LPI....43.1016M - N.A. Moskovitz, B. Yang, L.F. Lim, et al., 2012, <i>LPI Contribution</i> No. 1659, p.2080, "The near-Earth encounter of asteroid 2005 YU55: visible and near-infrared spectroscopy." See: http://adsabs.harvard.edu/abs/2012LPI....43.2080M - A.S. Rivkin, E.S. Howell, F.E. DeMeo, et al., 2012, <i>LPI Contribution</i> No. 1659, p.1537, "New observations and proposed meteorite analogs of the MarcoPolo-R target asteroid (175706) 1996 FG3." See: http://adsabs.harvard.edu/abs/2012LPI....43.1537R - I.M. Tielieusova, D.F. Lupishko, 2012, <i>LPI Contribution</i> No. 1659, p.1491, "The YORP-effect and axis rotation of Near-Earth

	Asteroids." See: http://adsabs.harvard.edu/abs/2012LPI....43.1491T
2012, Mar 20	Website tool made available by the NASA/JPL Near-Earth Object Program Office, for identifying mission-accessible Near-Earth Asteroids and their next observing opportunities: the NASA Near-Earth Object Human Space Flight Accessible Targets Study (NHATS). See: http://neo.jpl.nasa.gov/news/nhats.html
2012, Mar 26, 05:5	Apollo NEO 2012 FP35 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2012-06] See: 2012 FP35 - SSA , 2012 FP35 - JPL See also: http://www.space.com/15043-small-asteroids-earth-close-shave.html https://en.wikipedia.org/wiki/2012_FP35
2012, Mar 26, 17:0	Apollo NEA 2012 FS35 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.168 LD. Minimum miss distance 0.167 LD. [2012-07] See: 2012 FS35 - SSA , 2012 FS35 - JPL See also: http://www.space.com/15043-small-asteroids-earth-close-shave.html See also: 25 Mar 2012.
2012, Mar 26	3rd MarcoPolo-R Symposium: Scientific objectives of MarcoPolo-R near-Earth asteroid sample return mission, Manchester (UK), 26 March 2012. See: http://www.oa.eu/MarcoPolo-R/Workshops/WorkshopsMarcoPolo-R.html
2012, Mar 27	I. Israde-Alcántara, J.L. Bischoff, G. Domínguez-Vázquez, et al., 2012, <i>Proceedings of the National Academy of Sciences</i>, 109(13), 4723, "Evidence from central Mexico supporting the Younger Dryas extraterrestrial impact hypothesis." See: http://www.pnas.org/content/109/13/E738.full.pdf+html?sid=aaa1f113-bd1c-44fa-8d8b-8a2fd5ab33e8 See also: http://www.space.com/14793-comet-earth-impact-younger-dryas.html
2012, Mar 27-28	Large new impact crater (48.5 m) on Mars, suggesting an impactor several meters in diameter. See: http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA18384 See also: http://www.space.com/25980-huge-mars-crater-photos.html

2012, Mar 31	First light of first telescope of the Las Cumbres Observatory Global Telescope (LCOGT) network, Goleta (CA, USA). Eventually, the LCOGT network will deploy two or three identical 1-metre telescopes, each costing about US\$1 million, at observatories in Hawaii, Chile, South Africa, Australia and the Canary Islands. LCOGT also has two 2-metre robotic Faulkes telescopes in Australia and Hawaii. See: http://lcogt.net/ See also: http://www.nature.com/news/global-observatory-sees-first-light-1.10384 http://adsabs.harvard.edu/abs/2012DPS....4421516L
2012, Apr	M.A. Barucci, A.F. Cheng, P. Michel, et al. 2012, <i>Experimental Astronomy</i>, 33, 645, "MarcoPolo-R near earth asteroid sample return mission." See: http://adsabs.harvard.edu/abs/2012ExA....33..645B
2012, Apr	G. Cremonese, P. Borin, E. Martellato, et al., 2012, <i>Astrophysical Journal</i> (Letters), 749, L40, "New calibration of the micrometeoroid flux on Earth." See: http://adsabs.harvard.edu/abs/2012ApJ...749L..40C
2012, Apr	T.M. Eneev, R.Z. Akhmetshin, G.B. Efimov, 2012, <i>Cosmic Research</i>, 50, 93, "On the asteroid hazard." See: http://adsabs.harvard.edu/abs/2012CosRe..50...93E
2012, Apr	S. Greenstreet, B. Gladman, H. Ngo, et al., 2012, <i>Astrophysical Journal</i> (Letters), 749, L39, "Production of Near-Earth Asteroids on retrograde orbits." See: http://adsabs.harvard.edu/abs/2012ApJ...749L..39G
2012, Apr	A.W. Harris, G.B. Valsecchi, D. Morrison, 2012, in: I.F. Corbet (ed.), <i>Reports on Astronomy 2009-2012</i>, IAU Transactions XXVIII A (Cambridge: CUP), p.141, "Working Group: Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2012IAUTB..28..141H
2012, Apr	S.V. Karashevich, A.V. Devyatkin, I.A. Vereshchagina, et al., 2012, <i>Solar System Research</i>, 46, 130, "Astrometric and photometric studies of the 2009 WZ104 [PHA] asteroid as it approached the Earth." See: http://adsabs.harvard.edu/abs/2012SoSyR..46..130K
2012, Apr	V.A. Shor, Yu. A. Chernetenko, O.M. Kochetova, N.B. Zheleznov, 2012, <i>Solar System Research</i>, 46, 119, "On the impact of the Yarkovsky effect on Apophis' orbit." See: http://adsabs.harvard.edu/abs/2012SoSyR..46..119S

2012, Apr	K.J. Walsh, M. Delbò, M. Mueller, R.P. Binzel, F.E. DeMeo, 2012, <i>Astrophysical Journal</i> , 748, 104, "Physical characterization and origin of binary Near-Earth Asteroid (175706) 1996 FG3 ." See: http://adsabs.harvard.edu/abs/2012ApJ...748..104W
2012, Apr 1	S. Marchi, W.F. Bottke, D.A. King, A. Morbidelli, 2012, <i>Earth and Planetary Science Letters</i> , 325-326, 27, "The onset of the lunar cataclysm as recorded in its ancient crater populations." See: http://adsabs.harvard.edu/abs/2012E%26PSL.325...27M See also: http://lunarscience.nasa.gov/articles/nlsi-scientists-shed-light-moons-impact-history/
2012, Apr 1	Apollo NEA 2012 EG5 ($H = 24.5$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 0.60 LD. Minimum miss distance 0.60 LD. [2012-08] See: 2012 EG5 - SSA , 2012 EG5 - JPL Ref: - M. Hicks, S. Teague, C. Strojia, 2012, <i>The Astronomer's Telegram</i> , #4016, "Optical photometry of 2012 EG5 : constraints on taxonomy and spin rate." See: http://adsabs.harvard.edu/abs/2012ATel.4016....1H See also: http://www.space.com/15121-april-fools-day-asteroid-earth-flyby.html https://en.wikipedia.org/wiki/2012_EG5
2012, Apr 15	The Chinese spacecraft Chang'e-2 departed from L2 and began a mission to asteroid 4179 Toutatis (1989 AC , $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, NEA , PHA). Chang'e 2 was launched on 1 October 2010 for a lunar survey. On 8 June 2011, Chang'e-2 completed its extended mission, and left lunar orbit for the L2 Lagrangian point, to test the Chinese tracking and control network. The spacecraft is expected to make a flyby of Near-Earth Asteroid 4179 Toutatis on 13 December 2012 . See: http://en.wikipedia.org/wiki/Chang'e_2 Ref: - R. Stone, 2012, <i>Science</i> , 29 July 2012, "A new dawn for China's space scientists." See: http://www.sciencemag.org/content/336/6089/1630.summary?sid=87f26ee0-0564-40b0-9367-95573a612cfd
2012, Apr 19	Apollo NEA 2012 HM13 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.73 LD. [2012-09] See: 2012 HM13 - SSA , 2012 HM13 - JPL
2012, Apr 22	California/Nevada Fireball and Airburst, Sutter's Mill Meteorite. A

	bright ball of light traveling east to west was seen over the skies of central/northern California (USA) on April 22. Estimates of the object give it the size of a minivan, with a weight of ~70 metric tons and at the time of disintegration releasing an energy equivalent to a 5-kiloton explosion. See: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2012-114 See also: http://www.space.com/15654-meteorite-hunt-california-fireball.html http://www.space.com/15666-meteorite-fragments-searched-sierra-nevada-mountains-video.html http://www.rgj.com/article/20120423/NEWS/304230032/Scientist-says-sound-signal-from-exploding-meteor-lasting-18-minutes?nclick_check=1 http://hscience.kqed.org/quest/2012/12/20/stardust-and-sunbreath-in-the-sutters-mill-meteorite/ http://en.wikipedia.org/wiki/List_of_meteor_air_bursts Ref: - P. Jenniskens, B. Girten, D. Sears, et al., 2012, <i>Meteoritics and Planetary Science Supplement</i>, 75, 5376, "Recovery of the Sutter's Mill Meteorite." See: http://adsabs.harvard.edu/abs/2012M%26PSA..75.5376J - E. Underwood, Dec. 2012, <i>Science</i>, 338, 1521, "Sutter's Mill Meteorite produces mother lode of research." See: http://www.sciencemag.org/content/338/6114/1521 - P. Jenniskens, M.D. Fries, Qing-Zhu Yin, et al., (the Sutter's Mill Meteorite Consortium), Dec. 2012, <i>Science</i>, 338, 1583, "Radar-enabled recovery of the Sutter's Mill Meteorite, a carbonaceous chondrite regolith breccia." See: http://www.sciencemag.org/content/338/6114/1583.abstract
2012, Apr 24	Planetary Resources Inc. announced its formation and goals on April 24, 2012 at the Museum of Flight in Seattle (WA, USA). Press reports indicate that backers of the company including movie director and explorer James Cameron; Google executives Larry Page and Eric Schmidt; space entrepreneurs Eric Anderson and Peter Diamandis; and former Microsoft executive Charles Simonyi. The company reportedly plans to mine asteroids. See: http://www.museumofflight.org/press/space-exploration-company-make-major-announcement-museum-april-24-expand-earths-resource-bas-0 http://www.planetaryresources.com/ http://www.youtube.com/watch?v=s15PeKzmcU4&list=PL96FC1A30D88E0638&feature=plpp_play_all http://www.youtube.com/watch?v=t0c9oZh4vTo http://www.space.com/15405-asteroid-mining-feasibility-study.html http://www.space.com/15419-asteroid-mining-billionaires-private-spaceflight.html http://www.spacepolicyonline.com/events/planetary-resources-inc-press-conf-10-30-am-pt-1-30-pm-et-seattle http://edition.cnn.com/2012/04/25/showbiz/celebrity-news-gossip/james-

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2012, Apr 26	H. Thompson, 2012, <i>Nature</i> , 484, 429, "Ancient asteroids kept on coming. Two-billion-year barrage hit Earth when life was beginning." See: http://adsabs.harvard.edu/abs/2012Natur.484..429T
2012, May	P. Bodas, 2012, in: <i>American Astronomical Society, DDA meeting #43, #7.10</i> , "Keyholes and Jabbas: the role of pre-impact close approaches in asteroid deflection." See: http://adsabs.harvard.edu/abs/2012DDA...43.0710C
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2012, May 19	Apollo NEA 2010 KK37 ($H = 26.0$ mag, $D \approx 23$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.15 LD. [2012-12]

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2012, May 29	AIDA study. The Asteroid Impact & Deflection Assessment (AIDA) mission is a joint study effort of ESA, JHU/APL, NASA, OCA and DLR. The mission design foresees two independent spacecraft, one impactor (DART) and one rendezvous probe (AIM). As in the separate DART and AIM studies, the target of this mission is the binary NEA system 65803 Didymos (1996 GT , $H = 18.1$ mag, $D = 780 + 160$ m, PHA). Foreseen launch: 2020. Rendez-vous: October 2022. See: 65803 Didymos - SSA , 1996 GT -JPL See also: http://www.esa.int/esaMI/NEO/SEMH9CTWT1H_0.html http://www.esa.int/esaMI/NEO/SEMAWBTWT1H_0.html http://www.esa.int/Our_Activities/Technology/NEO/Asteroid_deflection_mission_seeks_smashing_ideas http://www.lpi.usra.edu/sbag/meetings/jan2013/presentations/sbag8_presentations/MON_1000_SBAG_ESA_NEO_explo%20studies_final.pdf http://www.hou.usra.edu/meetings/ipm2016/pdf/4043.pdf

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2012, May 29	NASA Workshop on Potentially Hazardous Asteroid 2011 AG5, NASA GSFC, Greenbelt (MD, USA), 29 May 2012. See: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2012-178 http://neo.jpl.nasa.gov/news/news175.html http://neo.jpl.nasa.gov/neo/2011_AG5_Deflection_Study_report_13.pdf http://neo.jpl.nasa.gov/neo/2011_AG5_exec_summary.pdf http://neo.jpl.nasa.gov/neo/2011_AG5_workshop_sum.pdf http://neo.jpl.nasa.gov/neo/2011_AG5_LN_intro_wksp.pdf See also: http://www.space.com/16169-earth-safe-asteroid-2011ag5-flyby.html
2012, May 29	Apollo NEA 2012 KT42 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.054 LD (= 3.3 R_{Earth} from the geocenter). Minimum miss distance 0.054 LD. [2012-14] See: 2012 KT42 - SSA , 2012 KT42 - JPL See also: http://www.space.com/15895-double-asteroid-earth-flyby.html http://www.slashgear.com/recently-discovered-asteroid-passes-very-near-

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2012, Jun 5	S.J. Robbins, B.M. Hynek, 2012, <i>Journal of Geophysical Research</i>, 117, E6, "A new global database of Mars impact craters ≥ 1 km: 2. Global crater properties and regional variations of the simple-to-complex transition diameter." See: http://www.agu.org/pubs/crossref/2012/2011JE003967.shtml See also: http://www.space.com/16153-mars-impact-crater-map.html
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	[2012-15] See: 2012 MF7 - SSA , 2012 MF7 - JPL
2012, Jun 23	Apollo NEA 496860 (1999 XL136, $H = 19.4$ mag, $D \approx 500$ m, PHA) passed Earth at a nominal miss distance of 4.49 LD. Minimum miss distance 4.49 LD. See: 1999 XL136 - SSA , 1999 XL136 - JPL See also: 22 Jun 1951.
2012, Jun 28	Sentinel Space Telescope Mission. The B612 Foundation announced plans to build, launch and operate the Sentinel Space Telescope Mission during a press conference at the Morrison Planetarium at the California Academy of Sciences in San Francisco (CA, USA). From the press release: "Sentinel is a space-based infrared (IR) survey mission to discover and catalog 90 percent of the asteroids larger than 140 meters in Earth's region of the solar system. The mission should also discover a significant number of smaller asteroids down to a diameter of 30 meters. Sentinel will be launched into a Venus-like orbit about the sun which significantly improves the efficiency of asteroid discovery during its 5.5 year mission. The spacecraft and instrument use high-heritage flight proven deep space systems, originally developed by NASA, to minimize technical and programmatic risks. These heritage missions include large space based telescopes (Spitzer, Kepler), a large format camera made up of many individual detectors (Kepler), and a cryogenically cooled instrument (Spitzer). By detecting and tracking nearly all of the Near Earth Objects greater than 50 meters in diameter, Sentinel will create a map of the solar system in Earth's neighborhood enabling future robotic and manned exploration. The Sentinel data will also identify objects that are potentially hazardous to humans to provide an early warning to protect the Earth from impact." Foreseen launch: 2018. Ref: - R. Schweickart, 15 February 2013, The Guardian, "Meteor and asteroid events give new focus for our vital Sentinel telescope." See: http://www.guardian.co.uk/commentisfree/2013/feb/15/meteor-strike-asteroid-pass-sentinel-telescope - E.T. Lu, H. Reitsema, J. Troeltzsch, S. Hubbard, March 2013, <i>New Space</i>, 1, 42, "The B612 Foundation Sentinel Space Telescope." See: http://online.liebertpub.com/doi/pdfplus/10.1089/space.2013.1500 - M.W. Buie, H. Reitsema, 2015, "Sentinel mission performance for surveying the near-earth object population." See: http://sentinelmission.org/wp-content/uploads/2015/04/sentinel-paper-from-Lunar-P.pdf? See also: http://b612foundation.org/b612/

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2012, Jul 22	Apollo NEA 153958 (2002 AM31), $H = 18.3$ mag, $D \approx 800$ m, PHA) passed Earth at a nominal miss distance of 13.7 LD. See: 153958 2002 AM31 - SSA , 2002 AM31 - JPL See also: http://www.universetoday.com/96384/watch-a-near-earth-asteroid-zoom-by/ http://www.dailymail.co.uk/sciencetech/article-2176561/Asteroid-nearly-mile-wide-sail-past-Earth-Sunday.html?ito=feeds-newsxml http://www.space.com/16802-near-earth-asteroid-fly-by-captured-by-observatory-video.html
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	- that for the largest NEOs, thanks to the efforts of the astronomical community and of several space agencies, the cataloguing of the potentially hazardous ones, the monitoring of their impact possibilities, and the analysis of technologically feasible mitigations is reaching a satisfactory level; - that even the impact of small- to moderate-sized objects may represent a great threat to our civilizations and to the international community; - that our knowledge of the number, size, and orbital behaviour of smaller objects is still very limited, thus not allowing any reasonable anticipation on the likelihood of future impacts, <i>noting</i> that NEOs are a threat to all nations on Earth, and therefore that all nations should contribute to avert this threat, <i>recommends</i> that the IAU National Members work with the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and the International Council for Science (ICSU) to coordinate and collaborate on the establishment of an International NEO Early Warning System, relying on the scientific and technical advice of the relevant astronomical community, whose main purpose is the reliable identification of potential NEO collisions with the Earth, and the communication of the relevant parameters to suitable decision makers of the nation(s) involved. Ref: - Montmerle, T. (ed.), 2015, <i>Transactions IAU XXVIII B</i>, Proceedings of the Twenty Eighth General Assembly, Beijing, China, 2012, p.39, "Resolution B3, on the establishment of an international early warning system." See: https://doi.org/10.1017/S1743921315005463
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2012, Oct 9	Apollo NEA 2012 TM79 ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.24 LD. Minimum miss distance 0.24 LD. [2012-17] See: 2012 TM79 - SSA , 2012 TM79 - JPL
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2012, Oct 12	Apollo NEA 2012 TC4 ($H = 26.7$ mag, $D \approx 15 \times 8$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.25 LD. [2012-18] See: 2012 TC4 - SSA , 2012 TC4 - JPL See also: http://www.space.com/18007-asteroid-coming-closer-than-the-moon-video.html https://en.wikipedia.org/wiki/2012_TC4 See also: 11 Oct 1986 , 12 Oct 2017 .
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2012, Nov 5	Apollo NEA 214869 (2007 PA8, $H = 16.6$ mag, $D \approx 1900 \times 1400 \times 1300$ m, PHA), passed Earth at a nominal miss distance of 16.85 LD. Minimum miss distance 16.85 LD. See: 214869 2007 PA8 - SSA , 2007 PA8 - JPL See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2012-350

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2012, Nov 6	Pristine Moon crater Linné could help unlock impacts' secrets on Earth. See: http://www.space.com/18354-virgin-moon-crater-reveals-vital-secrets-of-impacts-video.html http://www.space.com/18361-linne-crater-moon-nasa-lro.html http://en.wikipedia.org/wiki/Linn%C3%A9_(crater) Ref.: - J.B. Garvin, M.S. Robinson, J. Frawley, et al., 2011, in: <i>42nd Lunar and Planetary Science Conference</i> , " Linné : simple lunar mare crater geometry from LRO observations." See: http://www.lpi.usra.edu/meetings/lpsc2011/pdf/2063.pdf
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2012, Nov 12	Apollo NEA 2012 VH77 ($H = 27.3$ mag, $D \approx 15$ m), passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.52 LD. [2012-19] See: 2012 VH77 - SSA , 2012 VH77 - JPL
2012, Nov 14	Apollo NEA 2012 VJ38 ($H = 28.7$ mag, $D \approx 6$ m), passed Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.59 LD. [2012-20] See: 2012 VJ38 - SSA , 2012 VJ38 - JPL
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2012, Dec 14	Apollo NEA 2012 XB112 ($H = 30.1$ mag, $D \approx 3$ m), passed Earth at a

	nominal miss distance of 0.82 LD. Minimum miss distance 0.82 LD. [2012-22] See: 2012 XB112 - SSA , 2012 XB112 - JPL
2012, Dec 15	Apollo NEA 2012 XL134 ($H = 28.1$ mag, $D \approx 9$ m), passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.71 LD. [2012-23] See: 2012 XL134 - SSA , 2012 XL134 - JPL
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2013, Jan 15	Apollo NEA 2013 BR27 ($H = 28.0$ mag, $D \approx 9$ m), passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.56 LD. [2013-01] See: 2013 BR27 - SSA , 2013 BR27 - JPL
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2013, Jan 26	Apollo NEA 2021 CY8 ($H = 26.1$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 3.02 LD. Minimum miss distance 0.79 LD. See: 2021 CY8 – S2P , 2021 CY8 - JPL
2013, Jan 28	Apollo NEA 2013 CY ($H = 28.4$ mag, $D \approx 8$ m) passed Earth at a

	nominal miss distance of 0.90 LD. Minimum miss distance 0.90 LD. [2013-02] See: 2013 CY - SSA , 2013 CY - JPL
2013, Feb	M.-J. Kim, Y.-J. Choi, H.-K. Moon, et al., 2013, <i>Astronomy & Astrophysics</i> , 550, L11, "Optical observations of NEA 162173 (1999 JU3) during the 2011-2012 apparition." See: http://adsabs.harvard.edu/abs/2013A%26A...550L..11K
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2013, Feb 5	Apollo NEA 2013 CY32 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.27-LD. [2013-03] See: 2013 CY32 - SSA , 2013 CY32 - JPL
2013, Feb 8	H. Pälke, 2013, <i>Science</i> , 339, 655, "Impact and extinction." See: http://www.sciencemag.org/content/339/6120/655.summary
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2013, Feb 11	Apollo NEA 2013 CL129 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.72 LD. [2013-04] See: 2013 CL129 - SSA , 2013 CL129 - JPL
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2013, Feb 15	C.B. Agee, N.V. Wilson, F.M. McCubbin, et al., 2013, <i>Science</i>, 339, 780, "Unique meteorite from early Amazonian Mars: water-rich basaltic breccia Northwest Africa 7034." See: http://www.sciencemag.org/content/early/2013/01/02/science.1228858 See also: http://www.nasa.gov/mission_pages/mars/news/mars20130103.html http://www.space.com/19117-mars-meteorite-martian-missing-link.html
2013, Feb 15, 03:2	Impact. Chelyabinsk Superbolide, Fireball, Airburst and Meteorite. Infrasound data taken around the globe indicate that the pre-impacting asteroid had an estimated size of 17 to 20 meters and an estimated mass of 11,000 tons. It was an estimated 24th mag object just before impact. The asteroid approached the Earth along a direction that remained within 15 degrees of the direction of the Sun. Asteroid detection telescopes cannot scan regions of the sky this close to the Sun. The amount of energy released during the event was 440 kT TNT. The event took 32.5 seconds from atmospheric entry, with a velocity of ~18.6 km/s, to the meteorite's airborne disintegration at an altitude of 23.3 km. Three meteorite debris impact sites were found, two of which are in an area near Chebarkul Lake, west of Chelyabinsk (Ural, Russia). The third site was found ~80 km further to the northwest, near the town of Zlatoust. One of the fragments that struck near Chebarkul left a hole six meters in diameter in the frozen surface of a lake. The airburst shock wave, which arrived 88 seconds after the superbolide's flash, damaged numerous buildings, and blew out thousands of glass windows amid frigid winter weather. Over 1500 people needed medical attention for minor injuries. See: http://rt.com/news/meteorite-crash-urals-chelyabinsk-283/ http://marateaman.livejournal.com/27910.html http://www.space.com/19801-possible-meteor-blast-russia.html http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2013-061 http://www.jpl.nasa.gov/news/news.php?release=2013-061 http://blogs.nature.com/news/2013/02/incoming-russia-feels-meteor-blast.html http://science.time.com/2013/02/15/photos-russia-meteor-explosion-shatters-windows-injures-hundreds/#ixzz2OI5RTbA4 http://www.nytimes.com/2013/02/16/world/europe/meteorite-fragments-are-said-to-rain-down-on-siberia.html?nl=todaysheadlines&emc=edit_th_20130216&r=1& http://articles.washingtonpost.com/2013-02-

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2013, Jun 8	Apollo NEA 2013 LR6 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.29 LD. Minimum miss distance 0.29 LD. [2013-09] See: 2013 LR6 - SSA , 2013 LR6 - JPL

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2013, Jun 18	10,000-st Near Earth Object registered by the Minor Planet Center: Amor NEA 511002 (2013 MZ5), $H = 20.1$ mag, $D \approx 300$ m), when it passed Earth at a nominal distance of 180 LD. See: 2013 MZ5 - SSA , 2013 MZ5 - JPL The NASA site Near Earth Object Program / Discovery Statistics lists 10,003 NEOs: 94 Near Earth Comets and 9909 Near Earth Asteroids. The search continues. See: http://neo.jpl.nasa.gov/stats/ http://www.jpl.nasa.gov/news/news.php?release=2013-207 See also: http://www.space.com/21735-asteroid-telescope-finds-10000-space-rock.html https://en.wikipedia.org/wiki/2013_MZ5
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2013, Jun 25	Aten NEA 2021 MK1 ($H = 21.5$ mag, $D \approx 180$ m, PHA) passed Earth at a nominal miss distance of 1.13 LD. Minimum miss distance 0.54 LD. See: 2021 MK1 – S2P , 2021 MK1 - JPL See also: 25 Jun 2066.
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2013, Sep 18	Apollo NEA 2013 RZ53 ($H = 31.4$ mag, $D \approx 1.9$ m), passed Earth at a nominal miss distance of 0.63 LD. Minimum miss distance 0.63 LD. [2013-15] See: 2013 RZ53 - SSA , 2013 RZ53 - JPL See also: http://www.space.com/22818-asteroid-buzzing-earth-this-week-2013-rz53.html See also: 13 Mar 1954.
2013, Sep 19	S.D. Miller, W.C. Straka, A.S. Bachmeier, et al., 2013, <i>Proceedings of the National Academy of Sciences of the United States of America</i>, 110, 18092, "Earth-viewing satellite perspectives on the Chelyabinsk meteor event." See: http://www.pnas.org/content/110/45/18092.full
2013, Sep 25	B. Allen, J. Grindlay, J. Hong, R.P. Binzel, et al., 2013, <i>Proceedings of the SPIE</i>, 8840, 88400M, "The REGolith X-Ray Imaging Spectrometer (REXIS) for OSIRIS-REx: identifying regional elemental enrichment on asteroids." See: http://adsabs.harvard.edu/abs/2013SPIE.8840E..0MA
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2013, Sep 30 - Oct	NASA Asteroid Initiative Idea Synthesis Workshop, 30 September - 2 October 2013, Lunar and Planetary Institute, Houston (TX, USA).

	See: http://www.nasa.gov/content/asteroid-initiative-idea-synthesis-workshop/#.UkPg_H-TLpc
2013, Sep-Oct	C.W. Hergenrother, M.C. Nolan, R.P. Binzel, et al., 2013, <i>Icarus</i> , 226, 663, "Lightcurve, color and phase function photometry of the OSIRIS-REx target asteroid (101955) Bennu ." See: http://adsabs.harvard.edu/abs/2013Icar..226..663H
2013, Sep-Oct	S.P. Naidu, J.-L. Margot, M.W. Busch, et al., 2013, <i>Icarus</i> , 226, 323, "Radar imaging and physical characterization of Near-Earth Asteroid (162421) 2000 ET70 ." See: http://adsabs.harvard.edu/abs/2013Icar..226..323N
2013, Sep-Oct	M.C. Nolan, C. Magri, E.S. Howell, et al., 2013, <i>Icarus</i> , 226, 629, "Shape model and surface properties of the OSIRIS-REx target asteroid (101955) Bennu from radar and lightcurve observations." See: http://adsabs.harvard.edu/abs/2013Icar..226..629N
2013, Oct	J. Borovička, J. Tóth, A. Igaz, et al., 2013, <i>Meteoritics & Planetary Science</i> , 48, 1757, "The Košice meteorite fall : atmospheric trajectory, fragmentation, and orbit." See: http://adsabs.harvard.edu/abs/2013M%26PS...48.1757B
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2013, Oct	T.G. Müller, T. Miyata, C. Kiss, M.A. Gurwell, et al., 2013, <i>Astronomy & Astrophysics</i> , 558, 79, "Physical properties of asteroid (308635) 2005 YU55 derived from multi-instrument infrared observations during a very close Earth-approach." See: http://adsabs.harvard.edu/abs/2013A%26A...558A..97M
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2013, Oct	M. Tibbets, M. Elvis, J.L. Galache, et al., 2013, in: Proc. <i>Astronomical Data Analysis Software and Systems XXII</i> , ASP Conf. Series, 475, 259, " NEOview : Near Earth Object data discovery and

	query." See: http://adsabs.harvard.edu/abs/2013ASPC..475..259T
2013, Oct 1	D. Nakashima, N.T. Kita, T. Ushikubo, 2013, <i>Earth and Planetary Science Letters</i>, 379, 127, "Oxygen three-isotope ratios of silicate particles returned from asteroid Itokawa by the Hayabusa spacecraft: a strong link with equilibrated LL chondrites." See: http://adsabs.harvard.edu/abs/2013E%26PSL.379..127N
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2013, Oct 4	Apollo NEA 2013 TR12 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.56 LD. Minimum miss distance 0.56 LD. [2013-16] See: 2013 TR12 - SSA , 2013 TR12 - JPL
2013, Oct 6-11	45th AAS Division for Planetary Sciences Annual Meeting, 6-11 October 2013, Denver (CO, USA). See: http://aas.org/meetings/45th-meeting-division-planetary-sciences Among the papers: - P. Abell, N. Moskovitz, D. Trilling, et al., 2013, DPS meeting #45, #208.30, "The Mission Accessible Near-Earth Objects Survey (MANOS)." See: http://adsabs.harvard.edu/abs/2013DPS....4520830A - L. Allen, D. Trilling, B. Burt, et al., 2013, DPS meeting #45, #112.19, "A sensitive search for NEOs with the Dark Energy Camera." See: http://adsabs.harvard.edu/abs/2013DPS....4511219A - L.A. Benner, M. Brozovic, J.D. Giorgini, et al., 2013, "Goldstone radar images of Near-Earth Asteroid 2012 DA14." See: http://adsabs.harvard.edu/abs/2013DPS....4510102B - R.P. Binzel, F. DeMeo, 2013, DPS meeting #45, #208.07, "Latitudinal spectral variations on asteroid 101955 Bennu [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4520807B - M. Boslough, 2013, DPS meeting #45, #110.01, "The Chelyabinsk Airburst event." See: http://adsabs.harvard.edu/abs/2013DPS....4511001B - M. Brozovic, L. Benner, M. Busch, et al., 2013, DPS meeting #45, #101.09, "Goldstone radar imaging and shape modeling of Near-Earth Asteroid (214869) 2007 PA8 [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4510109B - B. Burt, D. Trilling, L. Allen, et al., 2013, DPS meeting #45, #112.20, "Applications of MOPS to NEO searches."

	See: http://adsabs.harvard.edu/abs/2013DPS....4511220B - M.W. Busch, M. Brozovic, L. Benner, et al., 2013, DPS meeting #45, #101.05, "Goldstone/VLA radar observations of Near-Earth Asteroid 4179 Toutatis [NEA, PHA] in 2012." See: http://adsabs.harvard.edu/abs/2013DPS....4510105B - B.J. Butler, M.A. Gurwell, A. Moullet, 2013, DPS meeting #45, #112.08, "Observations of NEA 1998 QE2 [PHA] with the SMA and VLA." See: http://adsabs.harvard.edu/abs/2013DPS....4511208B - C.R. Chapman, 2013, DPS meeting #45, #208.16, "2012 DA14 and Chelyabinsk: same day coincidence?" See: http://adsabs.harvard.edu/abs/2013DPS....4520816C - S.R. Chesley, D. Farnocchia, P.W. Chodas, A. Milani, 2013, DPS meeting #45, #106.08, "Yarkovsky-driven impact redictions: Apophis [NEA, PHA] and 1950 DA [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4510608C - P. Chodas, R. Gershman, 2013, DPS meeting #45, #401.01, "Finding and characterizing candidate targets for the Asteroid Redirect Robotic Mission (ARRM)." See: http://adsabs.harvard.edu/abs/2013DPS....4540101C - C. Comfort, H. Campins, J. de Leon, et al., DPS meeting #45, #112.10, "The origin of asteroid 162173 (1999 JU3) [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4511210C - G. Consolmagno, R.J. Macke, D.T. Britt, 2013, DPS meeting #45, #208.18, "Asteroid thermal properties derived from meteorite data." See: http://adsabs.harvard.edu/abs/2013DPS....4520818C - J. de Leon, N. Pinilla-Alonso, J. Ortiz, et al., 2013, "Results from ground-based observations of asteroid 2012 DA14 during its close-approach to the Earth on February 15th, 2013." See: http://adsabs.harvard.edu/abs/2013DPS....4510101D - M. Elvis, C. Beeson, J. Galache, et al., 2013, "LINNAEUS: boosting Near Earth Asteroid characterization rates." See: http://adsabs.harvard.edu/abs/2013DPS....4520824E - E.G. Fahnestock, S.R. Chesley, 2013, DPS meeting #45, #112.23, "Ejecta behavior and dynamics within the proposed ISIS kinetic impactor demonstration mission." See: http://adsabs.harvard.edu/abs/2013DPS....4511223F - D. Farnocchia, S.R. Chesley, D.J. Tholen, M. Micheli, 2013, DPS meeting #45, #106.03, "High precision predictions for Near-Earth Asteroids: the strange case of 3908 Nyx." See: http://adsabs.harvard.edu/abs/2013DPS....4510603F - J.L. Galache, C. Beeson, M. Elvis, 2013, DPS meeting #45, #112.25, "Near Earth Asteroid characterization: challenges and opportunities." See: http://adsabs.harvard.edu/abs/2013DPS....4511225G - M. Granvik, A. Morbidelli, R. Jedicke, et al., 2013, DPS meeting #45, #106.02, "A new population model of the orbits and absolute

	magnitudes of Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2013DPS....4510602G - M. Gritsevich, T. Kohout, V. Grokhovsky, et al., 2013, DPS meeting #45, #205.01, "A comprehensive study of Chelyabinsk Meteorite: physical, mineralogical, spectral properties and solar system orbit." See: http://adsabs.harvard.edu/abs/2013DPS....4520501G - C. Hartzell, M. Zimmerman, Y. Takahashi, D. Scheeres, 2013, DPS meeting #45, #208.13, "Numerical studies of electrostatic dust motion about Itokawa [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4520813H - C. Heath, D.A. Brain, 2013, DPS meeting #45, #118.10, "Influence of asteroid and comet impacts on atmospheric abundances at Venus, Earth, and Mars." See: http://adsabs.harvard.edu/abs/2013DPS....4511810H - E.S. Howell, M.W. Busch, V. Reddy, et al., 2013, DPS meeting #45, #301.01, "Using a radar shape model to interpret spectral observations of Near-Earth Asteroid 4179 Toutatis [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4530101H - S. Ieva, E. Dotto, D. Perna, et al., 2013, DPS meeting #45, #205.12, "Surface composition of low delta-V near-Earth asteroids, a survey of future targets for space missions." See: http://adsabs.harvard.edu/abs/2013DPS....4520512I - Y. JeongAhn, R. Malhotra, 2013, DPS meeting #45, #106.01, "The non-uniform distribution of the perihelia of Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2013DPS....4510601J - D. Jewitt, J. Li, J. Agarwal, 2013, DPS meeting #45, #201.05, "Discovery of the dust tail of asteroid 3200 Phaethon [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4520105J - L.F. Lim, N.A. Moskovitz, J. Licandro, et al., 2013, DPS meeting #45, #208.10, "Thermal emission photometry of Deep Impact flyby target (163249) 2002 GT [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4520810L - T. Lister, 2013, DPS meeting #45, #208.27, "Follow-up and characterization of NEOs with the LCOGT Network." See: http://adsabs.harvard.edu/abs/2013DPS....4520827L - S. Lowry, P.R. Weissman, S.R. Duddy, et al., 2013, DPS meeting #45, #304.04, "Direct detection of YORP spin-up on asteroid (25143) Itokawa [NEA, PHA] and implications for its internal structure." See: http://adsabs.harvard.edu/abs/2013DPS....4530404L - D. Morrison, 2013, DPS meeting #45, id.111.01, "End-of-the-world: using science to dispel public fear." See: http://adsabs.harvard.edu/abs/2013DPS....4511101M - N. Moskovitz, T. Endicott, T. Lister, et al., 2013, DPS meeting #45, #101.03, "The near-Earth flyby of asteroid 2012 DA14." See: http://adsabs.harvard.edu/abs/2013DPS....4510103M - S. Marshall, E.S. Howell, C. Magri, et al., 2013, DPS meeting #45,

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	See: http://adsabs.harvard.edu/abs/2013DPS....4520507T - D.E. Trilling, J.Hora, B.Burt, et al., 2013, DPS meeting #45, #304.02, "The size distribution of very small Near Earth Objects as measured by Warm Spitzer." See: http://adsabs.harvard.edu/abs/2013DPS....4530402T - F. Vilas, A. Hendrix, 2013, DPS meeting #45, #101.07, "Temporally-resolved UV/VIS reflectance spectra of Near-Earth Asteroid 163249 2002 GT [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4510107V - A.Q. Vodniza, M.R. Pereira, Arecibo Observatory Team; JPL Target Asteroids Team, 2013, DPS meeting #45, #208.11, "The asteroid 1998 QE2 [NEA, PHA]." See: http://adsabs.harvard.edu/abs/2013DPS....4520811V - R.J. Wainscoat, P. Veres, B. Bolin, et al., 2013, DPS meeting #45, #401.02, "The Pan-STARRS search for Near Earth Objects: recent progress and future plans." See: http://adsabs.harvard.edu/abs/2013DPS....4540102W - P.R. Weissman, S.C. Lowry, A. Rozek, et al., 2013, DPS meeting #45, #112.15, "Shape and rotation modeling and thermophysical analysis of Near-Earth Asteroid 1917 Cuyo." See: http://adsabs.harvard.edu/abs/2013DPS....4511215W - D.K. Yeomans, 2013, DPS meeting #45, #104.03, "Rocks from space: a historical perspective." See: http://adsabs.harvard.edu/abs/2013DPS....4510403Y
2013, Oct 6-11	2013 Carl Sagan Medal from the American Astronomical Society received by Donald K. Yeomans, during the AAS Division for Planetary Sciences annual meeting, 6 to 11 October 2013 in Denver (CO, USA). See: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2013-220
2013, Oct 9	Apollo NEA 2013 TL127 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.98 LD. Minimum miss distance 0.98 LD. [2013-17] See: 2013 TL127 - SSA , 2013 TL127 - JPL
2013, Oct 10	J. Borovička, J. Tóth, A. Igaz, 2013, <i>Meteoritics & Planetary Science</i>, 48, 1757, "The Košice meteorite fall: atmospheric trajectory, fragmentation, and orbit." See: http://onlinelibrary.wiley.com/doi/10.1111/maps.12078/
2013, Oct 17	P. Plait, <i>Bad Astronomy</i>, 17 October 2013, "Huge chunk of Russian meteorite found at the bottom of a lake." $M = 570$ kg, $D \approx 1$ m. See: http://www.slate.com/blogs/bad_astronomy/2013/10/17/chelyabinsk_impact_huge_chunk_of_asteroid_dredged_up_from_lake.html

	http://www.nytimes.com/2013/10/17/world/europe/meteorite-pulled-from-russian-lake-breaks-into-3-pieces.html?emc=edit_tnt_20131016&tntemail0=y&r=1&http://cdn.rt.com/files/news/20/c7/20/00/946221_meteo_2_web.mp4
2013, Oct 21	Apollo NEA 2013 UR1 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2013-18] See: 2013 UR1 - SSA , 2013 UR1 - JPL
2013, Oct 22	UN-COPUOS / AT14 plans to coordinate international efforts to defend the Earth from the threat posed by asteroids, presented to the United Nations General Assembly by UN-COPUOS chairman Yasushi Horikawa. The plans were set out in a draft resolution and accompanying report at a meeting of the UN's Fourth Committee of the General Assembly. The plans have yet to be formally adopted as a resolution by the General Assembly and are expected to be fully implemented at a vote in November-December 2013. See: http://www.un.org/apps/news/story.asp?NewsID=36449&Cr=general+assembly&Cr1=#.UneQvFOtOSp
2013, Oct 25	Apollo NEA 2013 UX2 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2013-19] See: 2013 UX2 - SSA , 2013 UX2 - JPL
2013, Oct 29	Apollo NEA 2013 UV3 ($H = 27.1$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.74 LD. Minimum miss distance 0.73 LD. [2013-20] See: 2013 UV3 - SSA , 2013 UV3 - JPL
2013, Oct-Nov	A.F.J. Abercromby, S.P. Chappell, M.L. Gernhardt, 2013, <i>Acta Astronautica</i>, 91, 34, "Desert RATS 2011: Human and robotic exploration of near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2013AcAau..91...34A
2013, Nov	T. Bose, S. Misra, S. Chakraborty, K. Reddy, 2013, <i>Earth, Moon, and Planets</i>, 111, 31, "Gamma (gamma)-ray activity as a tool for identification of hidden ejecta deposits around impact crater on basaltic target: example from Lonar Crater, India." See: http://adsabs.harvard.edu/abs/2013EM%26P..111...31B
2013, Nov	M.A. Galiuzzo, Á. Bazsó, M.S. Huber, et al., 2013, <i>Astronomische Nachrichten</i>, 334, 936, "A statistical dynamical study of meteorite impactors: A case study based on parameters derived from the Bosumtwi impact event."

	See: http://adsabs.harvard.edu/abs/2013AN....334..936G
2013, Nov	C.T. Russell, C.A. Raymond, R. Jaumann, et al., 2013, <i>Meteoritics & Planetary Science</i> , 48, 2076, " Dawn completes its mission at 4 Vesta ." See: http://adsabs.harvard.edu/abs/2013M%26PS...48.2076R
2013, Nov	S. Steinberg, C. Kundrot, J. Charles, 2013, <i>Acta Astronautica</i> , 92, 119, "Human health and performance considerations for Near Earth asteroids (NEA)." See: http://adsabs.harvard.edu/abs/2013AcAau..92..119S
2013, Nov	T. Terai, S. Urakawa, J. Takahashi, et al., 2013, <i>Astronomy & Astrophysics</i> , 559, 106, "Time-series photometry of Earth flyby asteroid 2012 DA14." See: http://adsabs.harvard.edu/abs/2013A%26A...559A.106T
2013, Nov	J.M. Madiedo, J.M. Trigo-Rodríguez, J.L. Ortiz, et al., 2013, <i>Monthly Notices Royal Astronomical Society</i> , 435, 2023, "Spectroscopy and orbital analysis of bright bolides observed over the Iberian Peninsula from 2010 to 2012." See: http://adsabs.harvard.edu/abs/2013MNRAS.435.2023M
2013, Nov 1	P. Pergola, 2013, <i>Advances in Space Research</i> , 52, 1622, "Small satellite survey mission to the second Earth moon [3753 Cruithne (1986 TO)]." See: http://adsabs.harvard.edu/abs/2013AdSpR..52.1622P
2013, Nov 4	M. Tibbits, M. Elvis, J.L. Galache, et al., 2013, in: <i>Proc. Astronomical Data Analysis Software and Systems XXII</i> , Champaign (Illinois, USA), 4-8 November 2012, ASP-CS 475, 259, " NEOview : Near Earth Object data discovery and query." See: http://adsabs.harvard.edu/abs/2013ASPC..475..259T
2013, Nov 5	S.D. Miller, W.C. Straka, A.B. Scott Bachmeier, et al., 2013, <i>Proceedings National Academy of Sciences</i> , 110, 18092, "Earth-viewing satellite perspectives on the Chelyabinsk meteor event." See: http://www.pnas.org/content/110/45/18092.short See also: http://www.space.com/23273-russia-meteor-chelyabinsk-satellite-photos.html

2013, Nov 8	Apollo NEA 2013 VJ11 ($H = 27.9$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.89 LD. Minimum miss distance 0.89 LD. [2013-21] See: 2013 VJ11 - SSA , 2013 VJ11 - JPL
2013, Nov 10	K.T. Howard, M.J. Bailey, D. Berhanu, 2013, <i>Nature Geoscience</i>, 6, 1018, "Biomass preservation in impact melt ejecta." See: http://adsabs.harvard.edu/abs/2013NatGe...6.1018H
2013, Nov 11-15	1st COSPAR Symposium Planetary systems of our Sun and stars, and the future of space astronomy, Bangkok (Thailand), 11-15 November 2013. Session 5: Small bodies. See: http://www.cospar2013.gistda.or.th
2013, Nov 14	J. Borovička, P. Spurný, P. Brown, et al., 2013, <i>Nature</i>, 503, 235, "The trajectory, structure and origin of the Chelyabinsk asteroidal impactor." See: http://adsabs.harvard.edu/abs/2013Natur.503..235B
2013, Nov 14	P.G. Brown, J.D. Assink, L. Astiz, et al., 2013, <i>Nature</i>, 503, 238, "A 500-kiloton airburst over Chelyabinsk and an enhanced hazard from small impactors." See: http://adsabs.harvard.edu/abs/2013Natur.503..238B See also: http://news.sciencemag.org/space/2013/11/siberian-blast-points-more-destructive-meteors-ahead
2013, Nov 15	J.D. Kramers, M.A.G. Andreoli, M. Atanasova, 2013, <i>Earth and Planetary Science Letters</i>, 382, 21, "Unique chemistry of a diamond-bearing pebble from the Libyan Desert Glass strewnfield, SW Egypt: Evidence for a shocked comet fragment." See: http://adsabs.harvard.edu/abs/2013E%26PSL.382...21K First ever evidence of a comet striking Earth. News release, 8 October 2013, University of the Witwatersrand, Johannesburg (South Africa): "... A comet entered Earth's atmosphere above Egypt about 28 million years ago. As it entered the atmosphere, it exploded, heating up the sand beneath it to a temperature of about 2 000 degrees Celsius, and resulting in the formation of a huge amount of yellow silica glass which lies scattered over a 6 000 square kilometer area in the Sahara. A magnificent specimen of the glass, polished by ancient jewellers, is found in Tutankhamun's brooch with its striking yellow-brown scarab. ..." See: http://www.wits.ac.za/newsroom/newsitems/201310/21649/news_item_21649.html

2013, Nov 16	S. Eggl, A. Ivantsov, D. Hestroffer, et al., 2013, in: L. Cambresy et al. (eds.), Proc. Annual Meeting of the French Society of Astronomy and Astrophysics (SF2A-2013), p. 169, "High-precision astrometry in asteroid mitigation - the NEOShield perspective." See: http://adsabs.harvard.edu/abs/2013sf2a.conf..169E
2013, Nov 16	D. Hestroffer, F. Deleflie, 2013, in: L. Cambresy et al. (eds.), Proc. Annual Meeting of the French Society of Astronomy and Astrophysics (SF2A-2013), p. 183, " PôDET : a centre for Earth dynamical environment." See: http://adsabs.harvard.edu/abs/2013sf2a.conf..183H
2013, Nov 20-22	NASA Asteroid Initiative Idea Synthesis Workshop , 20 - 22 November 2013, Lunar and Planetary Institute, Houston (TX, USA). See: http://www.nasa.gov/asteroidworkshop/
2013, Nov 21	C. de la Fuente Marcos, R. de la Fuente Marcos, 2013, <i>Monthly Notices Royal Astronomical Society</i> , 436, L15, "The Chelyabinsk superbolide : a fragment of asteroid 2011 EO40 ?" See: http://adsabs.harvard.edu/abs/2013MNRAS.436L..15D
2013, Nov 26	Apollo NEA 2013 NJ ($H = 22.1$ mag, $D \approx 130$ m) passed Earth at a nominal miss distance of 2.47 LD. Minimum miss distance 2.47 LD. See: 2013 NJ - JPL , 2013 NJ - SSA See also: 24 Nov 1956 , 24 Nov 1997 , 26 Nov 2067 .
2013, Nov 28	Editorial, 2013, <i>Nature Geoscience</i> , 6, 987, "The upside of impacts." See: http://www.nature.com/ngeo/journal/v6/n12/full/ngeo2036.html
2013, Nov 29	C.R. Chapman, 2013, <i>Science</i> , 342, 1051, "Calibrating asteroid impact." See: http://adsabs.harvard.edu/abs/2013Sci...342.1051C
2013, Nov 29	O.P. Popova, P. Jenniskens, V. Emel'yanenko, et al., 2013, <i>Science</i> , 342, 1069, " Chelyabinsk Airburst , damage assessment, meteorite recovery, and characterization." See: http://www.sciencemag.org/content/342/6162/1069
2013, Nov 29	Apollo NEA 2013 WH25 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.35 LD. Minimum miss distance 0.34 LD. [2013-22] See: 2013 WH25 - SSA , 2013 WH25 - JPL
2013, Dec	A. Fazio, M. D'Orazio, L. Folco, et al., 2013, <i>Meteoritics & Planetary Science</i> , 48, 2451, "The extremely reduced silicate-bearing iron meteorite Northwest Africa 6583 : implications on the variety of

	the impact melt rocks of the IAB-complex parent body." See: http://adsabs.harvard.edu/doi/10.1111/maps.12231
2013, Dec	N.A. Konovalova, J.M. Madiedo, J.M. Trigo-Rodríguez, 2013, <i>Meteoritics & Planetary Science</i> , 48, 2469, "The Tajikistan superbolide of July 23, 2008. I. Trajectory, orbit, and preliminary fall data." See: http://adsabs.harvard.edu/doi/10.1111/maps.12217
2013, Dec 11	A. Ivantsov, S. Eggli, D. Hestroffer, W. Thuillot, 2013, e-print <i>arXiv</i> :1312.3175, "On future opportunities to observe gravitational scattering of main belt asteroids into NEO source regions." See: http://adsabs.harvard.edu/abs/2013arXiv1312.3175I See also: http://syrtte.obspm.fr/journees2013/powerpoint/ivantsov_poster_jsr13.pdf
2013, Dec 11	Apollo NEA 2013 XS21 ($H = 29.4$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2013-23] See: 2013 XS21 - SSA , 2013 XS21 - JPL
2013, Dec 12	Jiangchuan Huang, Jianghui Ji, Peijian Ye, et al., 2013, <i>Nature Scientific Reports</i> , 3, article number 3411, "The ginger-shaped asteroid 4179 Toutatis : new observations from a successful flyby of Chang'e-2 ." See: http://adsabs.harvard.edu/abs/2013NatSR...3E3411H
2013, Dec 19	Launch of ESA spacecraft Gaia to Sun-Earth L2 Lagrangian point for a 5-yr mission. As part of its overall mission, with a limiting magnitude of $v \approx 20$ mag, Gaia (two 1.4×0.5 m telescopes, optical) is expected to detect $\sim 300,000$ minor planets, many of which will be NEOs, down to a solar elongation of 45° , with unprecedented accuracy. See: http://www.rssd.esa.int/Gaia http://www.esa.int/Our_Activities/Space_Science/Gaia/Gaia_overview http://blogs.esa.int/gaia/ http://www.esa.int/Our_Activities/Space_Science/Gaia/Countdown_to_launch_of_ESA_s_billion-star_surveyor http://www.esa.int/Our_Activities/Space_Science/Gaia/Gaia_Go_for_science Ref: - S. Mouret, D. Hestroffer, F. Mignard, 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symposium No. 236 on <i>Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i> , Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 435, "Asteroid mass determination with the Gaia mission."

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2013, Dec 19	NASA's asteroid hunter spacecraft NEOWISE returns first images after reactivation. Survey restart on 23 December 2013. See: http://www.jpl.nasa.gov/news/news.php?release=2013-373 http://www.jpl.nasa.gov/news/news.php?release=2014-006 http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2014-023
2013, Dec 21	J.M. Madiedo, J.M. Trigo-Rodríguez, J. Zamorano, et al., 2013, <i>Monthly Notices Royal Astronomical Society</i>, 436, 3656, "Analysis of a superbolide from a damocloid observed over Spain on 2012 July 13." See: http://adsabs.harvard.edu/abs/2013MNRAS.436.3656M
2013, Dec 23	Apollo NEA 2013 YB ($H = 31.4$ mag, $D \approx 1.8$ m) passed Earth at a nominal miss distance of 0.071 LD (= 4.26 R_{Earth} from the geocenter). Minimum miss distance 0.069 LD. [2013-24] See: 2013 YB - SSA , 2013 YB - JPL
2014, Jan 1	10476 NEAs known (ranging in size up to ~ 37 km: 1036 Ganymed, A924 UB, $H = 9.45$ mag, $D = 36.5$ km, Amor NEA), of which 1437 PHAs (ranging in size from 140 m up to ~ 5 km: 4179 Toutatis, 1989 AC, $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, Apollo NEA, PHA). See: http://neo.jpl.nasa.gov/stats/
2014	Cancelled: Launch of AsteroidFinder, a space project of the German Aerospace Center (DLR) with a one-year baseline mission duration, with a 25-cm telescope and a $2^\circ \times 2^\circ$ FoV, to operate in a Sun-synchronous low-Earth orbit. The primary goals are to estimate the population of NEOs interior to Earth's orbit (IEOs) down to $v = 18.5$ mag, their size distribution, and their orbital properties, along with impact hazard assessment. See: http://www.dlr.de/pf/en/desktopdefault.aspx/tabid-174/319_read-18911/ Ref: - M. Hartl, H. Mosebach, J. Schubert, 2010, abstract in: <i>International Conference on Space Optics</i>, Rhodes (Greece), 4-8 October 2010, "AsteroidFinder – the space-borne telescope to search for NEO asteroids."

	See: http://congrex.nl/.../FCXNL-10A02-1986358-2-HARTL_ICSO_PAPER[1].pdf See also: http://www.oosa.unvienna.org/pdf/pres/stsc2008/tech-13.pdf http://www.lpi.usra.edu/meetings/acm2008/pdf/8140.pdf http://www.unoosa.org/pdf/reports/ac105/AC105_976E.pdf Note: The project had successfully completed a Phase-B study in October 2011. Unfortunately, however, due to financial constraints, mainly due to the difficulty of procurement of an affordable launcher for the desired orbit, the project has been terminated shortly after (priv. comm.).
2014, Jan	V. Alí-Lagoa, L. Lionni, M. Delbo, et al., 2014, <i>Astronomy & Astrophysics</i>, 561, 45, "Thermophysical properties of Near-Earth Asteroid (341843) 2008 EV5 from WISE data*." See: http://adsabs.harvard.edu/abs/2014A%26A...561A..45A
2014, Jan	M. Ceccaroni, F. Biscani, J. Biggs, 2014, <i>Solar System Research</i>, 48, 33, "Analytical method for perturbed frozen orbit around an asteroid in highly inhomogeneous gravitational fields: a first approach." See: http://adsabs.harvard.edu/abs/2014SoSyR..48...33C
2014	G. Keller, A.C. Kerr (eds.), 2014, Proc., <i>Volcanism, Impacts, and Mass Extinctions: Causes and Effects</i>, Geological Society of America Special Papers, Vol. 505. See: http://specialpapers.gsapubs.org/content/505
2014, Jan	D.F. Lupishko, I.N. Tielieusova, 2014, <i>Meteoritics & Planetary Science</i>, 49, 80, "Influence of the YORP effect on rotation rates of near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2014M%26PS...49...80L
2014, Jan	P. Michel, M.A. Barucci, A.F. Cheng, et al., 2014, <i>Acta Astronautica</i>, 93, 530, "MarcoPolo-R: Near-Earth Asteroid sample return mission selected for the assessment study phase of the ESA program cosmic vision." See: http://adsabs.harvard.edu/abs/2014AcAau..93..530M
2014, Jan 1	M. Connors, 2014, <i>Monthly Notices of the Royal Astronomical Society</i>, 437, L85, "A Kozai-resonating Earth quasi-satellite." See: http://adsabs.harvard.edu/abs/2014MNRAS.437L..85C
2014, Jan 1	F.E. DeMeo, R.P. Binzel, M. Lockhart, 2014, <i>Icarus</i>, 227, 112, "Mars encounters cause fresh surfaces on some near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2014Icar..227..112D See also:

	http://web.mit.edu/newsoffice/2013/asteroids-mars-1119.html
2014, Jan 1	Apollo NEA 2014 AF5 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.25 LD. [2014-01] See: 2014 AF5 - SSA , 2014 AF5 - JPL See also: https://en.wikipedia.org/wiki/2014_AF5
2014, Jan 2	M. Mommert, J.L. Hora, A.W. Harris, et al., 2014, <i>Astrophysical Journal</i> , 781, 25, "The discovery of cometary activity in Near-Earth Asteroid (3552) Don Quixote ." See: http://adsabs.harvard.edu/abs/2014ApJ...781...25M
2014, Jan 2, 03:13	Impact. Apollo NEA 2014 AA ($H = 30.9$ mag, $D \approx 2.3$ m), was calculated to hit Earth at a nominal miss distance of 0.00118 LD (0.071 R_{Earth} = 455 km from the Earth center), with a minimum miss distance of 0.00066 LD. It probably burned in the Earth atmosphere over the Atlantic Ocean, off the coast of West Africa, 21 hours after observation. See: 2014 AA - SSA , 2014 AA - JPL See also: http://www.minorplanetcenter.net/mpec/K14/K14A02.html http://www.jpl.nasa.gov/news/news.php?release=2014-001 https://en.wikipedia.org/wiki/2014_AA See also: 3 Nov 1967, 26 May 1994, 21 Mar 1996.
2014, Jan 5	M. Shao, C. Zhai, T. Werne, et al., 2014, <i>AAS Meeting #223</i> , id.255.30, "Detection of a small fast moving Near Earth Asteroid with synthetic tracking." See: http://adsabs.harvard.edu/abs/2014AAS...22325530S
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2014, Jan 8	Apollo NEA 2014 AK51 ($H = 26.5$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.96 LD. [2014-02] See: 2014 AK51 - SSA , 2014 AK51 - JPL
2014, Jan 8-9	10th NASA Small Bodies Assessment Group Meeting , 8-9 January 2014, Washington (DC, USA). See: http://www.lpi.usra.edu/sbag/ http://www.lpi.usra.edu/sbag/meetings/jan2014/agenda.shtml

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2014, Jan 9	Apollo NEA 2014 AG51 ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a

	nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2014-03] See: 2014 AG51 - SSA , 2014 AG51 - JPL
2014, Jan 10	Apollo NEA 2014 AW32 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2014-04] See: 2014 AW32 - SSA , 2014 AW32 - JPL See also: 10 Jan 1941.
2014, Jan 13-14	First IAWN Steering Group Meeting, 13-14 January 2014, Minor Planet Center, Cambridge (MA, USA). See: http://minorplanetcenter.net/IAWN http://www.minorplanetcenter.net/IAWN/index.html http://minorplanetcenter.net/IAWN/mpc-un/index.html http://www.minorplanetcenter.net/IAWN/2014_cambridge/findings.html http://iawn.net Presentations: Overview: - S. Camacho , 2014, "Welcome and introduction to the IAWN, UNCOPUOS." See: http://minorplanetcenter.net/IAWN/mpc-un/camacho.pdf - L. Johnson , 2014, "NASA's NEO Observations Program." See: http://minorplanetcenter.net/IAWN/mpc-un/johnson_nasa.pdf - T. Spahr, 2014, "The International Asteroid Warning Network and the Minor Planet Center." See: http://minorplanetcenter.net/IAWN/mpc-un/spahr_mpc.pdf Reports on physical observations: - R.S. McMillan, T.H. Bressi, J.A. Larsen, et al., 2014, "Spacewatch and follow-up astrometry of Near-Earth Objects." See: http://minorplanetcenter.net/IAWN/mpc-un/mcmillan_iawn2014.pdf - R.P. Binzel, 2014, "Spectroscopic reconnaissance of NEOs." See: http://minorplanetcenter.net/IAWN/mpc-un/binzel.pdf - V. Reddy, J. Sanchez, E. Cloutis, et al., 2014, "Surface composition of small NEOs in light of Chelyabinsk: implications for impact hazard assessment." See: http://minorplanetcenter.net/IAWN/mpc-un/reddy_chelyabinsk.pdf - E.V. Ryan, 2014, "NEO physical characterization: spin rates and spectra." See: http://minorplanetcenter.net/IAWN/mpc-un/ryan_iawn2014.pdf - L. Benner, 2014, "Arecibo and Goldstone radar observations of Near-Earth Objects." See: http://minorplanetcenter.net/IAWN/mpc-un/benner.iawn.jan2014.pdf Reports on survey status: - H. Viggh, 2014, "Lincoln Near-Earth Asteroid Research program (LINEAR)." See: http://minorplanetcenter.net/IAWN/mpc-un/viggh_iawn2014.pdf

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2014, Jan 28	M.-H. Zhu, W. Fa, W.-H. Ip, et al., 2014, <i>Geophysical Research Letters</i>, 41, 328, "Morphology of asteroid (4179) Toutatis as imaged by Chang'E-2 spacecraft."

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2014, Feb	D. Farnocchia, S.R. Chesley, 2014, <i>Icarus</i> , 229, 321, "Assessment of the 2880 impact threat from asteroid (29075) 1950 DA ." See: http://adsabs.harvard.edu/abs/2014Icar..229..321F
2014, Feb	Y. JeongAhn, R. Malhotra, 2014, <i>Icarus</i> , 229, 236, "On the non-uniform distribution of the angular elements of Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2014Icar..229..236J
2014, Feb	D. Koschny, 2014, <i>WGN, Journal of the International Meteor Organization</i> , 42, 3, "Meteoroids, asteroids, and the professional-amateur collaboration." See: http://adsabs.harvard.edu/abs/2014JIMO...42....3K
2014, Feb	S.C. Lowry, P.R. Weissman, S.R. Duddy, et al., 2014, <i>Astronomy & Astrophysics</i> , 562, 48, "The internal structure of asteroid (25143) Itokawa as revealed by detection of YORP spin-up." See: http://adsabs.harvard.edu/abs/2014A%26A...562A..48L
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2014, Mar 6, 03:20	Apollo NEA 2014 EF ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [2014-07] See: 2014 EF - SSA , 2014 EF - JPL
2014, Mar 6, 21:18	Apollo NEA 2014 EC ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.16 LD. Minimum miss distance 0.16 LD. [2014-08] See: 2014 EC - SSA , 2014 EC - JPL

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2014, May 7	Apollo NEA 2014 JR24 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2014-13] See: 2014 JR24 - SSA , 2014 JR24 - JPL
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2014, Jun 3, 17:38	Aten NEA 2014 LY21 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.052 LD (= 3.15 R_{Earth} from the geocenter). Minimum miss distance 0.023 LD. [2014-18] See: 2014 LY21 - SSA , 2014 LY21 - JPL See also: https://en.wikipedia.org/wiki/2014_LY21
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2014, Sep 7	Apollo NEA 2014 RC ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.104 LD. Minimum miss distance 0.104 LD. [2014-23] See: 2014 RC - SSA , 2014 RC - JPL See also: http://neo.jpl.nasa.gov/news/news184.html http://neo.jpl.nasa.gov/news/news185.html https://en.wikipedia.org/wiki/2014_RC See also: 4 Sep 1945 .
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	http://iawn.net/category/meetings/ See also: http://www.space.com/27809-asteroid-impact-early-warning-system.html Case studies: - L. Delgado López (SWF), 2014, "Impact hazard communication risk study: 2007 VK184". See: http://www.minorplanetcenter.net/IAWN/first_communication_workshop/2007-vk184-case-study-iawn-delgado-9-14.pdf - J.L. Galache, 2014, "2012 DA14 and Chelyabinsk Meteor case study." See: http://www.minorplanetcenter.net/IAWN/first_communication_workshop/2012-da14-chelyabinsk-case-study-iawn-galache-9-14.pdf - L. David, 2014, "What's up or down with Apophis? An open case or case closed?" See: http://www.minorplanetcenter.net/IAWN/first_communication_workshop/apophis-case-study-iawn-david-9-141.pdf - L. Billings, 2014, "Impact hazard communication case study: 2011 AG5." See: http://www.minorplanetcenter.net/IAWN/first_communication_workshop/2011-ag5-case-study-iawn-billings-9-14.pdf
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2014, Sep 24	R. Schweickhart, 2014, <i>Sentinel Mission Blog</i> , 24 september 2014, presentation at NASA Ames Research Center Director's Colloquium, 17 July 2014, presented by the Office of the Chief Scientist as part of the Center's 75th anniversary celebration, "Dinosaur syndrome avoidance project - how gozit?" See: http://sentinelmission.org/events/rustys-talk-dinosaur-syndrome-avoidance-project-how-gozit/
2014, Oct	M. Beech, 2014, <i>Earth, Moon, and Planets</i> , 113, 53, "Grazing impacts upon Earth's surface: towards an understanding of the Rio Cuarto Crater Field ." See: http://link.springer.com/article/10.1007/s11038-014-9445-7
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2014, Oct 1	Apollo NEA 2014 TL ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.26 LD. Minimum miss distance 0.25 LD. [2014-25] See: 2014 TL - SSA , 2014 TL - JPL See also: 29 Mar 2060 .
2014, Oct 6	C. Domercant, A. Gonzalez, 2014, e-print <i>arXiv:1410.1589</i> , "A new method of capturing and transporting asteroid to a lunar orbit." See: http://adsabs.harvard.edu/abs/2014arXiv1410.1589D
2014, Oct 6	A. Ivantsov, S. Eggli, D. Hestroffer, et al., 2014, in: Z. Knežević (ed.), 2014, <i>Proceedings IAU Symposium No. 310</i> , Complex Planetary Systems, "Close encounters of Near Earth Objects with large asteroids." See: http://adsabs.harvard.edu/abs/2014arXiv1410.1357I http://arxiv.org/pdf/1410.1357v1.pdf
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2014, Oct 18	Apollo NEA 2016 UD ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.08 LD. [2014-26] See: 2016 UD - SSA , 2016 UD - JPL See also: 17 Oct 2016.
2014, Oct 19	Apollo NEA 2014 UU56 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.68 LD. Minimum miss distance 0.68 LD. [2014-27] See: 2014 UU56 - SSA , 2014 UU56 - JPL
2014, Oct 20	Apollo NEA 2014 TW57 ($H = 19.7$ mag, $D \approx 470$ m) passed Earth at a nominal miss distance of 0.35 AU. Minimum miss distance 0.35 AU. See: 2014 TW57 – SSA , 2014 TW57 – JPL Hefele et al. (February, 2020) predict a close approach of 0.017 AU = 6.62 LD in September 2165. Re: - J.D. Hefele, F. Bortolussi, S. Portegies Zwart, 2020, <i>Astronomy & Astrophysics</i>, 634, 45, “Identifying Earth-impacting asteroids using an artificial neural network.” See: https://www.aanda.org/articles/aa/full_html/2020/02/aa35983-19/aa35983-19.html See also: https://www.astronomie.nl/leiden-astronomers-discover-potential-near-earth-objects-76 See also: September 2165.
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2014, Oct 27	Apollo NEA 2014 UF56 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2014-28] See: 2014 UF56 - SSA , 2014 UF56 - JPL
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2014, Nov 1	Y. Yu, D.C. Richardson, P. Michel, et al., 2014, <i>Icarus</i>, 242, 82, "Numerical predictions of surface effects during the 2029 close approach of asteroid 99942 Apophis."

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2014, Nov 9-14	46th Annual Meeting of the AAS Division for Planetary Sciences, Tucson AZ, USA), 9-14 November 2014. See: http://aas.org/meetings/dps46 Among the papers: - P. Abell, J.A. Nuth, D. Mazanek, et al., 2014, <i>DPS meeting</i> #46, #403.01, "NASA's Asteroid Redirect Mission: the boulder capture option." See: http://adsabs.harvard.edu/abs/2014DPS....4640301A - L. Allen, D. Trilling, F. Valdes, et al., 2014, <i>DPS meeting</i> #46, #414.01 "The DECam NEO Survey: a sensitive, wide-field search for near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2014DPS....4641401A - L.A. Benner, M. Brozovic, J.D. Giorgini, et al., 2014, <i>DPS meeting</i> #46, #409.01, "Goldstone and Arecibo Radar Images of Near-Earth Asteroid 2014 HQ124." See: http://adsabs.harvard.edu/abs/2014DPS....4640901B - E.C. Beshore, D. Lauretta, 2014, <i>DPS meeting</i> #46, #214.07, "The OSIRIS-REx mission sample site selection process." See: http://adsabs.harvard.edu/abs/2014DPS....4621407B - R.P. Binzel, F.E. DeMeo, J.B. Burt, et al., 2014, <i>DPS meeting</i> #46, #213.06, "Meteorite source regions as revealed by the Near-Earth Object population." See: http://adsabs.harvard.edu/abs/2014DPS....4621306B - W. Bottke, D. Vokrouhlicky, K. Walsh, et al., <i>DPS meeting</i> #46, #400.05, "In search of the source of Bennu, the OSIRIS-REx sample return mission target." See: http://adsabs.harvard.edu/abs/2014DPS....4640005B - P.G. Brown, K. Dube, E. Silber, 2014, <i>DPS meeting</i> #46, #403.02, "Detecting NEO impacts using the International Monitoring System." See: http://adsabs.harvard.edu/abs/2014DPS....4640302B - M. Brozovic, L. Benner, T. Ford, et al., 2014, <i>DPS meeting</i> #46, #409.04, "Radar evidence for diverse shapes of the primaries among binary near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2014DPS....4640904B - M.W. Busch, L. Benner, M. Brozovic, et al., 2014, <i>DPS meeting</i> #46, #409.05, "Recent radar speckle observations of Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/2014DPS....4640905B - K.C. Chambers, 2014, <i>DPS meeting</i> #46, #214.06, "The Pan-STARRS discovery machine." See: http://adsabs.harvard.edu/abs/2014DPS....4621406C - S.R. Chesley, D. Farnocchia, P. Brown, P.W. Chodas, 2014, <i>DPS meeting</i> #46, #403.03, "Orbit estimation for late warning asteroid impacts: the case of 2014 AA."

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	- Z. Ivezić, L. Jones, 2014, <i>DPS meeting</i> #46, #214.14, "LSST: Comprehensive NEO detection, characterization, and orbits." See: http://adsabs.harvard.edu/abs/2014DPS....4621414I - J.A. Johnson, E.J. Christensen, A.R. Gibs, et al., 2014, <i>DPS meeting</i> #46, #414.09, "The Catalina Sky Survey: status, discoveries and the future." See: http://adsabs.harvard.edu/abs/2014DPS....4641409J - A. Jackson, E. Asphaug, L. Elkins-Tanton, 2014, <i>DPS meeting</i> #46, #420.01, "Stop hitting yourself: did most terrestrial impactors originate from the terrestrial planets?" See: http://adsabs.harvard.edu/abs/2014DPS....4642001J - J.T. Keane, I. Matsuyama, 2014, <i>DPS meeting</i> #46, #403.08, "Rejuvenating NEOs: the efficiency of asteroid resurfacing via planetary flybys." See: http://adsabs.harvard.edu/abs/2014DPS....4640308K - S.J. Kortenkamp, 2014, <i>DPS meeting</i> #46, #403.09, "The nearest of the Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2014DPS....4640309K - J.A. Larsen, R.S., McMillan, J.V. Scotti, 2014, <i>DPS meeting</i> #46, #213.12, "Spacewatch taxonomic photometry of Near-Earth Objects detected by NEOWISE." See: http://adsabs.harvard.edu/abs/2014DPS....4621312L - D. Lauretta, 2014, <i>DPS meeting</i> #46, #503.01, "The physical, geological, and dynamical nature of asteroid (101955) Bennu - target of OSIRIS-REx." See: http://adsabs.harvard.edu/abs/2014DPS....4650301L - T. Lister, E. Gomez, E. Christensen, S. Larson, 2014, <i>DPS meeting</i> #46, #414.10, "The LCOGT Near Earth Object (NEO) follow-up network." See: http://adsabs.harvard.edu/abs/2014DPS....4641410L - A.K. Mainzer, T. Grav, J. Bauer, et al., 2014, <i>DPS meeting</i> #46, #509.01, "Current and future space-based mid-infrared surveys for minor planets." See: http://adsabs.harvard.edu/abs/2014DPS....4650901M - S. Marshall, R.J. Vervack, C. Magri, et al., 2014, <i>DPS meeting</i> #46, #509.06, "Shape-based thermal modeling of three Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/2014DPS....4650906M - K.J. Miller, P.A. Taylor, C. Magri, et al., 2014, <i>DPS meeting</i> #46, #213.13, "Detectability of boulders on Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/2014DPS....4621313M - M. Mommert, D. Trilling, T. Axelrod, et al., 2014, <i>DPS meeting</i> #46, #213.08, "Rapid response near-infrared spectrophotometric characterization of Near Earth Objects." See: http://adsabs.harvard.edu/abs/2014DPS....4621308M - N. Moskovitz, D. Polishhook, C. Thomas, et al., 2014, <i>DPS meeting</i> #46, #503.09 "The Mission Accessible Near-Earth Object Survey

	(MANOS): Project Overview." See: http://adsabs.harvard.edu/abs/2014DPS....4650309M - C. Nugent, A. Mainzer, J. Masiero, et al., 2014, <i>DPS meeting</i> #46, #509.03, "Near-Earth asteroid surface thermal inertias with NEOWISE." See: http://adsabs.harvard.edu/abs/2014DPS....4650903N - V. Reddy, J. Sanchez, R. Klima, et al., <i>DPS meeting</i> #46, #213.10, "Was the Chelyabinsk meteoroid a fragment of Potentially Hazardous Asteroid (86039) 1999 NC43?" See: http://adsabs.harvard.edu/abs/2014DPS....4621310R - B. Rozitis, E. MacLennan, J.P. Emery, 2014, <i>DPS meeting</i> #46, #509.08, "Detection of cohesive forces in the rubble-pile asteroid (29075) 1950 DA." See: http://adsabs.harvard.edu/abs/2014DPS....4650908R - W. Ryan, E.V. Ryan, L.K. Johnson, 2014, <i>DPS meeting</i> #46, #213.17, "Real-time characterization of Near-Earth Objects: new spectral capabilities at the Magdalena Ridge Observatory 2.4-meter telescope." See: http://adsabs.harvard.edu/abs/2014DPS....4621317R - J.V. Scotti, R.S. McMillan, J.A. Larsen, 2014, <i>DPS meeting</i> #46, #414.17, "Spacewatch astrometry of asteroids and comets with the Bok 2.3-m and Mayall 4-m telescopes.." See: http://adsabs.harvard.edu/abs/2014DPS....4641417S - M. Shao, T. C.-X. Zhai, S. Turyshev, et al., 2014, <i>DPS meeting</i> #46, #414.18, "Synthetic tracking observation of Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2014DPS....4641418S - A. Springmann, P.A. Taylor, M.C. Nolan, et al., 2014, <i>DPS meeting</i> #46, #409.02, "Radar-derived shape model of Near-Earth Binary Asteroid system (285263) 1998 QE2." See: http://adsabs.harvard.edu/abs/2014DPS....4640902S - R.D. Stephens, B.D. Warner, A.W. Harris, D.R. Coley, 2014, <i>DPS meeting</i> #46, #213.09, "Near-Earth Asteroid program at the Center for Solar System Studies." See: http://adsabs.harvard.edu/abs/2014DPS....4621309S - D. Takir, B.E. Clark, D.S. Lauretta, 2014, <i>DPS meeting</i> #46, #503.02, "Bidirectional reflectance distribution functions for the OSIRIS-REx target asteroid (101955) Bennu." See: http://adsabs.harvard.edu/abs/2014DPS....4650302T - R.J. Wainscoat, B. Bolin, K. Chambers, et al., 2014, <i>DPS meeting</i> #46, #414.19, "The Pan-STARRS search for Near Earth Objects." See: http://adsabs.harvard.edu/abs/2014DPS....4641419W - N. Wigton, J.P. Emery, A.S. Rivkin, C.A. Thomas, 2014, <i>DPS meeting</i> #46, #213.16, "Near-Infrared (2 - 4 μm) spectroscopy of Near-Earth Asteroids: searching for OH/H₂O on small planetary bodies." See: http://adsabs.harvard.edu/abs/2014DPS....4621316W

2014, Nov 11	<i>Second meeting International Asteroid Warning Network Steering Committee meeting</i>, Tucson (AZ, USA), 11 November 2014. See: http://sservi.nasa.gov/iawn/ Among the presentations: - T. Spahr, 2014, "International Asteroid Warning Network: recent updates and MPC summary." See: http://sservi.nasa.gov/wp-content/uploads/2014/11/Spahr_Tucson_IAWN.pdf - J.L. Galache, 2014, "Workshop on communicating about asteroid impact warnings and mitigation plans." See: http://sservi.nasa.gov/wp-content/uploads/2014/11/Galache_DPS-2014-IAWN-Steering-Committee-Meeting1.pdf - B.D. Warner, 2014, "Clearing the dusty filing cabinets." See: http://sservi.nasa.gov/wp-content/uploads/2014/11/Warner_IAWN_ALCDEF.pdf - N. Moskovitz, 2014, "Rapid response characterization of Near Earth Objects." See: http://sservi.nasa.gov/wp-content/uploads/2014/11/IAWN14_Moskovitz.pdf - J. Bauer, 2014, "NEOWISE/WISE characterization results." See: http://sservi.nasa.gov/wp-content/uploads/2014/11/Bauer_IAWNb.pdf - P. Taylor: 2014, "Arecibo radar observations of Near-Earth Asteroids." See: http://sservi.nasa.gov/wp-content/uploads/2014/11/Howell_IAWN-Arecibo.pdf
2014, Nov 13	Aten NEA 2014 WE6 ($H = 30.6$ mag, $D \approx 2.7$ m) passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.57 LD. [2014-29] See: 2014 WE6 - SSA , 2014 WE6 - JPL
2014, Nov 14	L. Billings & NASA/JPL Near-Earth Object Program Office, 2014, "Newly released map data shows frequency of small asteroid impacts, provides clues on larger asteroid population." See: http://neo.jpl.nasa.gov/news/news186.html http://neo.jpl.nasa.gov/fireball/
2014, Nov 15	Apollo NEA 2014 WJ6 ($H = 27.0$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.87 LD. Minimum miss distance 0.86 LD. [2014-30] See: 2014 WJ6 - SSA , 2014 WJ6 - JPL
2014, Nov 18	<i>ESA SSA-NEO Final Presentation Day</i>, 18 November 2014, ESRIN, Frascati (Italy). See: http://space-env.esa.int/indico/conferenceDisplay.py?ovw=True&confId=68 Proceedings: - SSA-SN-V: Operation of the NEO Coordination Centre.

	See: http://space-env.esa.int/indico/getFile.py/access?resId=2&materialId=slides&confId=68 - SSA-SN-VII: NEO impact effects & mitigation measures study. See: http://space-env.esa.int/indico/internalPage.py?pageId=2&confId=68 - Synthetic generation of a NEO population. See: <http://...>. - F. Bernardi, 2014, NEODyS, AstDyS, and priority list data provision. See: http://space-env.esa.int/indico/getFile.py/access?resId=1&materialId=slides&confId=68 - SSA-NEO Final Presentation Day 2014 at ESRIN - Part 1. See: http://m.esa.int/spaceinvideos/Videos/2014/11/SSA-NEO_Final_Presentation_Day_2014_at_ESRIN_-_Part_1 - SSA-NEO Final Presentation Day 2014 at ESRIN - Part 2. See: http://m.esa.int/spaceinvideos/Videos/2014/11/SSA-NEO_Final_Presentation_Day_2014_at_ESRIN_-_Part_2
2014, Nov 20	L. David, 2014, <i>Space.com</i>, 20 November 2014, "Asteroid impact threat: experts report on early-warning strategies." See: http://www.space.com/27809-asteroid-impact-early-warning-system.html
2014, Nov-Dec	G. Mengali, A.A. Quarta, 2014, <i>Acta Astronautica</i>, 104, 450, "Optimal nodal flyby with near-Earth asteroids using electric sail." See: http://adsabs.harvard.edu/abs/2014AcAau.104..450M
2014, Dec	F. Spoto, A. Milani, D. Farnocchia, et al., 2014, <i>Astronomy & Astrophysics</i>, 572, 100, "Nongravitational perturbations and virtual impactors: the case of asteroid (410777) 2009 FD." See: http://adsabs.harvard.edu/abs/2014A%26A...572A.100S
2014, Dec	X.-Y. Zeng, Sh-P. Gong, J.-F. Li, 2014, <i>Acta Astronautica</i>, 105, 40, "Fast solar sail rendezvous mission to Near Earth Asteroids." See: http://adsabs.harvard.edu/abs/2014AcAau.105...40Z
2014, Dec	IAA Press Release 14/5, Dec. 2014, Hypothetical asteroid impact exercise posed for 2015 IAA Planetary Defense Conference. See: http://iaaweb.org/iaa/Scientific%20Activity/prpdc2015.pdf
2014, Dec 1	M.G. Sokolova, Y.A. Nefedyev, N.Y. Varaksina, 2014, <i>Advances in Space Research</i>, 54, 2415, "Asteroid and comet hazard: identification problem of observed space objects with the parental bodies." See: http://adsabs.harvard.edu/abs/2014AdSpR..54.2415S
2014, Dec 2	M. Yoshikawa (JAXA), J. Watanabe, (NAOJ), N. Takahashi, S. Urakawa (JSGA), 2014, Tokyo (Japan), APRSAF-21, "Asia-Pacific Asteroid Observation Network."

	See: https://aprsaf.org/annual_meetings/aprsaf21/pdf/new_cooperation_session/Proposal_4_APAON_AP21_NewCoop_rev.pdf See also: http://www.spaceguard.or.jp/apaon/index.html http://iaaweb.org/iaa/Scientific%20Activity/conf/pdc2015/IAA-PDC-15-01-05ab.pdf
2014, Dec 3	Launch of NEA sample return mission Hayabusa 2. This is a follow-on to the Hayabusa mission, and carried out by the Japanese space agency JAXA. The target is NEA Ryugu (162173, 1999 JU3). The Hayabusa 2 spacecraft is expected to arrive at the target in 2018, survey the NEA for 1.5 year, depart in December 2019, and return to Earth in December 2020. For this mission the Germany space agency DLR built a small lander called MASCOT (Mobile Asteroid Surface Scout) for the mission, in cooperation with the French space agency CNES. See: http://blogs.nature.com/news/2012/02/japan%e2%80%99s-second-asteroid-probe-gets-the-green-light.html http://www.dlr.de/irs/en/desktopdefault.aspx/tabid-7902/13482_read-34316 http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-5375/year-all/ http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10080/150_read-5773/year-all/ http://www.space.com/19064-japan-asteroid-sample-mission-hayabusa2.html http://www.lpi.usra.edu/sbag/meetings/jan2013/presentations/sbag8_presentations/TUES_0900_Hayabusa-2.pdf http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-7355/year-all/#gallery/11287 http://b612.jspec.jaxa.jp/hayabusa2/e/index_e.html http://global.jaxa.jp/press/2014/09/20140930_h2af26.html http://global.jaxa.jp/projects/sat/hayabusa2/ http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-12372/year-all/#/gallery/17357 http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-18664/year-all/#/gallery/23720 http://en.wikipedia.org/wiki/Hayabusa_2 Ref: - N. Moskovitz, S. Abe, D. Osip, et al., 2012, American Astronomical Society, DPS meeting #44, #102.04, "Characterization of Hayabusa 2 target asteroid (162173) 1999 JU3." See: http://adsabs.harvard.edu/abs/2012DPS....4410204M - F. Vilas, 2012, American Astronomical Society, DPS meeting #44, #102.03, "New spectral reflectance observations of Hayabusa 2 Near-Earth Asteroid target 162173 1999 JU3." See: http://adsabs.harvard.edu/abs/2012DPS....4410203V - D. Lazzaro, M.A. Barucci, D. Perna, et al., 2012, Astronomy & Astrophysics, 549, 2, "Rotational spectra of (162173) 1999 JU3, the target of the Hayabusa 2 mission."

	See: http://adsabs.harvard.edu/abs/2013A%26A...549L...2L - N.A. Moskovitz, S. Abe, K.-S. Pan, et al., 2013, <i>Icarus</i>, 224, 24, "Rotational characterization of Hayabusa II target asteroid (162173) 1999 JU3." See: http://adsabs.harvard.edu/abs/2013Icar..224...24M
2014, Dec 5	Resolution 69/85 adopted by the United Nations General Assembly on 5 December 2014, 9/10 : "The General Assembly, ... 9. Notes the importance of information-sharing in discovering, monitoring and physically characterizing potentially hazardous near- Earth objects to ensure that all countries, in particular developing countries with limited capacity in predicting and mitigating a near- Earth object impact, are aware of potential threats, emphasizes the need for capacity-building for effective emergency response and disaster management in the event of a near-Earth object impact, and recalls in that regard the recommendations for an international response to the near-Earth object impact threat, endorsed by the Scientific and Technical Subcommittee at its fiftieth session and by the Committee at its fifty-sixth session; 10. Notes with satisfaction that progress on establishing an international asteroid warning network and a space mission planning advisory group to implement the recommendations for an international response to the near-Earth object impact threat would be reported to the Subcommittee at its fifty-second session; ... See: http://www.unoosa.org/pdf/gares/A_RES_69_085E.pdf
2014, Dec 7	Apollo NEA 2014 WX202 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.98 LD. Minimum miss distance 0.98 LD. [2014-31] See: 2014 WX202 - SSA , 2014 WX202 - JPL See also: 2 Sep 1979.
2014, Dec 11	C. de la Fuente Marcos, R. de la Fuente Marcos, 2014, <i>Monthly Notices Royal Astronomical Society</i>, 445, 2985, "Asteroid 2014 OL339: yet another Earth quasi-satellite." See: http://adsabs.harvard.edu/abs/2014MNRAS.445.2985D Erratum, 1 February 2016: <i>Monthly Notices Royal Astronomical Society</i>, 455, 4030.
2014, Dec 12	R. Stone, 2014, <i>Science</i>, 346, 1281, "Back from the dead." See: http://adsabs.harvard.edu/abs/2014Sci...346.1281S
2014, Dec 18	Preparing for an asteroid strike, <i>ESA NEO Newsletter</i>, 18 December 2014. See: http://131.176.152.51/web/guest/home/- /journal_content/56_INSTANCE_j5kH/10157/13789?p_p_state=pop_up&

	56 INSTANCE j5kH viewMode=print
2014, Dec 26	Apollo NEA 2014 YR14 ($H = 25.9$ mag, $D \approx 23$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2014-32] See: 2014 YR14 - SSA , 2014 YR14 - JPL
2014, Dec 26	G. Leone, P.J. Tackley, T.V. Gerya, et al., 2014, <i>Geophysical Research Letters</i> , 41, 8736, "Three-dimensional simulations of the southern polar giant impact hypothesis for the origin of the Martian dichotomy." See: http://adsabs.harvard.edu/abs/2014GeoRL..41.8736L See also: https://spaceguardcentre.com/giant-asteroid-collision-may-have-radically-transformed-mars/
2015, Jan 1	11943 NEAs known (ranging in size up to ~ 37 km: 1036 Ganymed , A924 UB , $H = 9.45$ mag, $D = 36.5$ km, Amor NEA), of which 1527 PHAs (ranging in size from 140 m up to ~ 5 km: 4179 Toutatis , 1989 AC , $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, Apollo NEA, PHA). See: http://neo.jpl.nasa.gov/stats/
2015	L.D. Schmadel, 2015, <i>Dictionary of Minor Planet Names</i> , Addendum to 6th Edition: 2012-2014, ISBN 978-3-319-17676-5 (Switzerland: Springer International Publishing). See: http://adsabs.harvard.edu/abs/2015dmpn.book.....S
2015, Jan	C.C. Bryce, G.Horneck, E. Rabbow, et al., 2015, <i>International Journal of Astrobiology</i> , 14, 115, "Impact shocked rocks as protective habitats on an anoxic early Earth." See: http://adsabs.harvard.edu/abs/2015IJAsB..14..115B
2015, Jan	Yanlong Bu, Geshi Tang, KaiChang Di, et al., 2015, <i>The Astronomical Journal</i> , 149, 21. "New insights of asteroid 4179 Toutatis using China Chang'e-2 close flyby optical measurements." See: http://adsabs.harvard.edu/abs/2015AJ....149...21B
2015, Jan	H.C. Connolly, D.S. Lauretta, K.J. Walsh, et al., 2015, <i>Earth, Planets and Space</i> , 67, 12, "Towards understanding the dynamical evolution of asteroid 25143 Itokawa : constraints from sample analysis." See: http://adsabs.harvard.edu/abs/2015EP%26S...67...12C
2015, Jan	A.S. Hamers, S.F. Portegies Zwart, 2015, <i>Monthly Notices of the Royal Astronomical Society</i> , 446, 710, "Probing the formation of planetesimals in the Galactic Centre using Sgr A* flares." See: http://adsabs.harvard.edu/abs/2015MNRAS.446..710H

2015, Jan	A.A. Ledkov, N.A. Eismont, M.N. Boyarskii, et al., 2015, <i>Astronomy Letters</i> , 41, 67, "Control of the motion of near-Earth asteroids." See: http://adsabs.harvard.edu/abs/2015AstL...41...67L
2015, Jan	D.E. Vavilov, Y.D. Medvedev, 2015, <i>Monthly Notices of the Royal Astronomical Society</i> , 446, 705, "A fast method for estimation of the impact probability of near-Earth objects." See: http://adsabs.harvard.edu/abs/2015MNRAS.446..705V
2015, Jan	T.J. Zegmont, J.L. Galache, M. Elvis, 2015, in: American Astronomical Society Meeting #225 , #137.18, "Near-Earth Asteroid characterisation: gotta catch 'em all!." See: http://adsabs.harvard.edu/abs/2015AAS...22513718Z
2015, Jan 1	Jianfeng Cao, Yong Liua, Songjie Hua, et al., 2015, <i>Advances in Space Research</i> , 55, 491, "Navigation of Chang'E-2 asteroid exploration mission and the minimum distance estimation during its fly-by of Toutatis ." See: http://adsabs.harvard.edu/abs/2015AdSpR..55..491C
2015, Jan 1	C. de la Fuente Marcos, R. de la Fuente Marcos, 2015, <i>Monthly Notices of the Royal Astronomical Society (Letters)</i> , 446, L31, "Recent multi-kiloton impact events: are they truly random?" See: http://adsabs.harvard.edu/abs/2015MNRAS.446L..31D
2015, Jan 1	M. Hirabayashi, D.J. Scheeres, 2015, <i>The Astrophysical Journal (Letters)</i> , 798, L8, "Stress and failure analysis of rapidly rotating asteroid (29075) 1950 DA ." See: http://adsabs.harvard.edu/abs/2015ApJ...798L...8H
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2015, Jan 18	Apollo NEA 2015 BP513 ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2015-02] See: 2015 BP513 - SSA , 2015 BP513 - JPL See also: https://en.wikipedia.org/wiki/2015_BP513
2015, Jan 20	Apollo NEA 2015 BE511 ($H = 28.7$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2015-03] See: 2015 BE511 - SSA , 2015 BE511 - JPL

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2015, Feb 4	Minor Planet Center appointed Matthew J. Holman Interim Director. See: http://www.minorplanetcenter.org/blog/?p=922 http://www.minorplanetcenter.net/about
2015, Feb. 4-5	Workshop on Early Solar System Impact Bombardment III, Houston (TX, USA), 4-5 February 2015. See: http://www.hou.usra.edu/meetings/bombardment2015/ Among the papers: - S. Mazrouei, R. R. Ghent, W.F.Bottke, 2015, <i>LPI Contribution</i> No. 1826, p.3032, "Application of a new method for exploring the Copernican cratering record." See: http://adsabs.harvard.edu/abs/2015LPICo1826.3032M - D.A. Minton, A.P. Jackson, E. Asphaug, et al., 2015, <i>LPI Contribution</i> No. 1826, p.3033, "Debris from Borealis Basin formation as the primary impactor population of Late Heavy Bombardment." See: http://adsabs.harvard.edu/abs/2015LPICo1826.3033M - N. Movshovitz, F. Nimmo, D.G. Korycansky, et al., 2015, <i>LPI Contribution</i> No. 1826, p.3013, "Destruction and re-Accretion of outer Solar System satellites during the Late Heavy Bombardment." See: http://adsabs.harvard.edu/abs/2015LPICo1826.3013M - P.H. Schultz, 2015, <i>LPI Contribution</i> No. 1826, p.3031, "Sizes of asteroids responsible for large impact basins on the Moon during the Late Heavy Bombardment." See: http://adsabs.harvard.edu/abs/2015LPICo1826.3031S - T.D. Swindle, D.A. Kring, 2015, <i>LPI Contribution</i> No. 1826, p.3030, "Was there a concentration of lunar and asteroidal impacts at ~4000 Ma?" See: http://adsabs.harvard.edu/abs/2015LPICo1826.3030S - D.R. Lowe, G.R. Byerly, 2015, <i>LPI Contribution</i> No. 1826, p.3015, "The terrestrial record of an extended Late Heavy Bombardment." See: http://adsabs.harvard.edu/abs/2015LPICo1826.3015L - S. Marchi, W.F. Bottke, L.T. Elkins-Tanton, et al., 2015, "The bombardment of the Earth during the Hadean and early Archean

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2015, Feb 6	Anon., 2015, NASA/JPL Near-Earth Object Program Office News, "Number of known accessible Near-Earth Asteroids doubles since 2010." "NASA performed the first Near-Earth Object Human Space Flight Accessible Targets Study (NHATS) in September/October of 2010, and 666 of the known near-Earth asteroids (NEAs) were identified as meeting the NHATS criteria for mission accessibility (classifying those NEAs as "NHATS-compliant"). These are asteroids in near-Earth orbits that are more dynamically accessible (requiring less time and energy to visit) than round-trip spacecraft missions to Mars. ... On January 18, 2015 - a little over four years since the NHATS assessments began - the 1332nd NHATS-compliant asteroid was identified, doubling the number of known accessible NEAs. The first one, 1943 Anteros (1973 EC, H = 15.75 mag, D ≈ 2.48 km) was discovered on 13 March 1973." See: http://neo.jpl.nasa.gov/news/news189.html See also: http://neo.jpl.nasa.gov/nhats/ https://en.wikipedia.org/wiki/1943_Anteros See also: 13 March 1973, 23 May 2038, 20 May 2050.
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2015, Feb 16	Apollo NEA 2020 SN6 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 2.99 LD. Minimum miss distance 0.05 LD. See: 2020 SN6 – 2SP , 2020 SN6 – JPL See also: 4 Oct 2027 .
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2015, Feb 17	M. Jutzi, K. Holsapple, K. Wünneman, P. Michel, 2015, e-print <i>arXiv:1502.01844</i> , "Modeling asteroid collisions and impact processes." See: http://adsabs.harvard.edu/abs/2015arXiv150201844J
2015, Feb 18	Aten NEA 2015 DQ224 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.26 LD. [2015-06] See: 2015 DQ224 - SSA , 2015 DQ224 - JPL
2015, Feb 18	R. Schweickhart, 2015, <i>Rusty's Planetary Defense Blog</i> #2 - "Deflect, or duck and cover?" See: http://www.asteroidday.org/asteroid-day-expert-blog/2015/2/18/asteroid-day-blog-2-deflect-or-duck-cover
2015, Feb 27	R. Schweickhart, 2015, <i>Rusty's Planetary Defense Blog</i> #3 - "How many are we talking about, anyway?" See: http://www.asteroidday.org/asteroid-day-expert-blog/2015/2/26/asteroid-day-blog-3-how-many-are-we-talking-about-anyway
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2015, Mar	R.G. Strom, R. Malhotra, Z. Xiao, et al., 2015, <i>Research in Astronomy and Astrophysics</i> , 15, 407, "The inner solar system cratering record and the evolution of impactor populations." See: http://adsabs.harvard.edu/abs/2015RAA....15..407S

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2015, Mar	Proceedings XXVIIIth General Assembly of the IAU, Beijing, (China) 20-31 August 2012, T. Montmerle (ed.), <i>Highlights of Astronomy</i>, Vol. 16 (Cambridge: CUP), <i>Joint Discussion JD5 -From meteors and meteorites to their parent bodies: current status and future developments.</i> Preface, p. 137; http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9581023&fulltextType=RA&fileId=S1743921315001568 Among the papers: - D. Green, 2015, p.141, "The legacy of Brian G. Marsden (1937-2010)." See: http://adsabs.harvard.edu/abs/2015HiA....16..141G - T.J. Jopek, I.P. Williams, 2015, p.143, "Stream and sporadic meteoroids associated with Near Earth Objects." See: http://adsabs.harvard.edu/abs/2015HiA....16..143J - H. Yano, 2015, p.152, "Future small body exploration after the investigation of asteroid Itokawa by remote sensing and returned sample analyses." See: http://adsabs.harvard.edu/abs/2015HiA....16..152Y - V. Emel'yanenko, 2015, p.153 "Near-Earth objects from the cometary flux." See: http://adsabs.harvard.edu/abs/2015HiA....16..153E - M. Ishiguro, 2015, p.158, "Disk-resolved spectra of 25143) Itokawa with Hayabusa / AMICA observations." See: http://adsabs.harvard.edu/abs/2015HiA....16..158I - P. Michel, Luisa-M. Lara, B. Marty, et al., 2015, p.163, "MarcoPolo-R: Near Earth Asteroid sample return mission candidate as ESA-M3 class mission". See: http://adsabs.harvard.edu/abs/2015HiA....16..163M - B. Pulat, K. Gulchekhra, 2015, p.169, "Meteor showers of the Earth-crossing asteroids." See: http://adsabs.harvard.edu/abs/2015HiA....16..169P - M. Tichy, M. Honkova, J. Ticha, M. Kocer, 2015, p.185, "Strategy for NEO follow-up observations." See: http://adsabs.harvard.edu/abs/2015HiA....16..185T
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2015, Mar 1	NEOShield-2: Science and Technology for Near-Earth Object Impact Prevention. The NEOShield-2 project, continuing on from the NEOShield project has officially started on March the 1st, 2015 and shall extend over two and a half years. In response to the PROTEC-2-2014 call of

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2015, Mar 6	NASA spacecraft Dawn reached dwarf planet (former "Main-belt asteroid") 1 Ceres ($H = 3.34$ mag, $D = 952$ km) and went into orbit for five months of operations, till July 2015. See: http://dawn.jpl.nasa.gov/ http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2014-313 http://www.jpl.nasa.gov/news/news.php?release=2014-443 http://en.wikipedia.org/wiki/Ceres_(dwarf_planet)
2015, Mar 7	A.Y. Glikson, A.J. Meixner, B. Radke, et al., 2015, <i>Tectonophysics</i>, 643, 55, "Geophysical anomalies and quartz deformation of the Warburton West structure, central Australia" See: https://www.sciencedirect.com/science/article/abs/pii/S0040195114006477 See also: https://spaceguardcentre.com/worlds-largest-asteroid-impacts-found-in-central-australia/
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2015, Jun 10-19	<i>UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), 58th session</i> , 10-19 June 2015, Vienna (Austria), including meetings of STSC WG NEO and STSC Action Team 14 on NEOs . See: http://www.unoosa.org/pdf/limited/l/AC105_L292AEVE.pdf http://www.unoosa.org/oosa/en/ourwork/copuos/2015/index.html Final report: http://www.unoosa.org/res/oosadoc/data/documents/2015/a/a7020_0_html/A_70_20E.pdf
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2015, Nov 2	ESA SSA-NEO Coordination Centre Newsletter, 2 November 2015. See: http://neo.ssa.esa.int/newsletters
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2015, Nov 6	Aten NEA 2015 VU64 ($H = 30.8$ mag, $D \approx 2.4$ m) passed Earth at a nominal miss distance of 0.26 LD. Minimum miss distance 0.26 LD. [2015-23] See: 2015 VU64 - SSA , 2015 VU64 - JPL
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2015, Nov 20	Apollo NEA 2015 WP2 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.60 LD. Minimum miss distance 0.60 LD. [2015-25] See: 2015 WP2 - SSA , 2015 WP2- JPL
2015, Nov 23	NASA draft report from the Asteroid Redirect Mission Formulation Assessment and Support Team (ARM), for public comment . See: https://www.nasa.gov/arm http://www.nasa.gov/feature/arm-fast http://www.nasa.gov/sites/default/files/atoms/files/fast-final-report-draft-for-public-comment.pdf http://www.jpl.nasa.gov/news/news.php?feature=6593
2015, Nov 24	Apollo NEA 2015 VO142 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at

	a nominal miss distance of 1.02 LD. Minimum miss distance 1.02 LD. See: 2015 VO142 - SSA , 2015 VO142- JPL
2015, Dec	Ch.-Ch. Bao, H.-W. Yang, B.-Z. Barsbold, H.-X. Baoyin, 2015, <i>Astrophysics and Space Science</i> , 360, 61, "Capturing near-Earth asteroids into bounded Earth orbits using gravity assist." See: http://adsabs.harvard.edu/abs/2015Ap%26SS.360...61B
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2015, Dec	V.V. Busarev, S.I. Barabanov, V.S. Rusakov, et al., 2015, <i>Icarus</i> , 262, 44, "Spectrophotometry of (32) Pomona, (145) Adeona, (704) Interamnia, (779) Nina, (330825) 2008 XE3 , and 2012 QG42 and laboratory study of possible analog samples." See: http://adsabs.harvard.edu/abs/2015Icar..262...44B
2015, Dec	H.C. Connolly, D.S Lauretta, K.J. Walsh, et al., 2015, <i>Earth, Planets and Space</i> , 67, 12, "Towards understanding the dynamical evolution of asteroid 25143 Itokawa : constraints from sample analysis." See: http://adsabs.harvard.edu/abs/2015EP%26S...67...12C
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2015, Dec	D.D. Mazanek, R.G. Merrill, J.R. Brophy, et al., 2015, <i>Acta Astronautica</i> , 117, 163, " Asteroid Redirect Mission concept: a bold approach for utilizing space resources." See: http://adsabs.harvard.edu/abs/2015AcAau.117..163M
2015, Dec	B. Napier, D. Asher, M. Bailey, D. Steel, 2015, <i>Astronomy & Geophysics</i> , 56, 6.24, "Centaurs as a hazard to civilization." See: http://adsabs.harvard.edu/abs/2015A%26G....56f6.24N
2015, Dec	C. R. Nugent, A. Mainzer, J. Masiero, et al., 2015, <i>Astrophysical Journal</i> , 814, 117, " NEOWISE reactivation mission year one: preliminary asteroid diameters and albedos." See: http://adsabs.harvard.edu/abs/2015ApJ...814..117N
2015, Dec	J. Park, B.D. Turrin, G.F. Herzog, et al., 2015, <i>Meteoritics & Planetary Science</i> , 50, 2087, " ⁴⁰ Ar/ ³⁹ Ar age of material returned from

	asteroid 25143 Itokawa." See: http://adsabs.harvard.edu/abs/2015M%26PS...50.2087P
2015, Dec	C. Tubiana, C. Snodgrass, R. Michelsen, et al., 2015, <i>Astronomy & Astrophysics</i>, 584, 97, "2P/Encke, the Taurid complex NEOs and the Maribo and Sutter's Mill meteorites." See: http://adsabs.harvard.edu/abs/2015A%26A...584A..97T
2015, Dec 1	K. Muinonen, M. Granvik, A. Penttilä, M. Gritsevich (eds.), 2015, Proceedings Part 1 <i>International Conference Asteroids, Comets, Meteors 2014</i>, Helsinki (Finland), 30 June - 4 July 2014, <i>Planetary and Space Science</i>, 118. Among the papers: - K. Muinonen, M. Granvik, A. Penttilä, M. Gritsevich, et al., 2015, <i>Planetary and Space Science</i>, 118, 1. "Asteroids, Comets, Meteors, and their interrelations, Part I: Editorial review." - See: http://adsabs.harvard.edu/abs/2015P%26SS..118...1M - A.V. Andronikov, I.E. Andronikova, D.H. Hill, 2015, <i>Planetary and Space Science</i>, 118, 54, "Impact history of the Chelyabinsk meteorite: electron microprobe and LA-ICP-MS study of sulfides and metals." - See: http://adsabs.harvard.edu/abs/2015P%26SS..118...54A - L. Drube, A. Harris, 2014, "Metallic asteroids in the IRAS minor planet survey --- a NEOShield study." - See: http://adsabs.harvard.edu/abs/2014acm..conf..140D - V.V. Emel'yanenko, 2015, <i>Planetary and Space Science</i>, 118, 302, "Dynamical evolution of Chelyabinsk-type bodies from sungrazing orbits to near-Earth space." - See: http://adsabs.harvard.edu/abs/2015P%26SS..118..302E - J.A. Fernández, A. Sosa, 2015, , <i>Planetary and Space Science</i>, 118, 14, "Jupiter family comets in near-Earth orbits: Are some of them interlopers from the asteroid belt." - See: http://adsabs.harvard.edu/abs/2015P%26SS..118...14F - T.Yu. Galushina, G.O. Ryabova, P.V. Skripnichenko, 2015, <i>Planetary and Space Science</i>, 118, 296, "The force model for asteroid (3200 Phaethon)." - See: http://adsabs.harvard.edu/abs/2015P%26SS..118..296G - A. Harris, L. Drube, 2014, "How to find metal-rich asteroids --- a NEOShield study." - See: http://adsabs.harvard.edu/abs/2014acm..conf..204H - D. Koschny, M. Busch, 2015, <i>Planetary and Space Science</i>, 118, p. 305, "The Teide Observatory Tenerife Asteroid Survey." - See: http://adsabs.harvard.edu/abs/2015P%26SS..118..305K - D. Perna, M.A. Barucci, L. Drube, et al., 2015, <i>Planetary and Space Science</i>, 118, 311, "A global response roadmap to the asteroid impact threat: the NEOShield perspective." - See: http://adsabs.harvard.edu/abs/2015P%26SS..118..311P

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2015, Dec 1	ESA SSA-NEO Coordination Centre Newsletter, 1 December 2015. See: http://neo.ssa.esa.int/newsletters
2015, Dec 8-9	AASSA Regional Workshop on SHER Communication, Jakarta, 8-9 December 2015. See: http://www.interacademies.net/ProjectsAndActivities/10880/28034.aspx
2015, Dec 11	Aten NEA 33342 (1998 WT24), $H = 18.3$ mag, $D \approx 415$ m, PHA) passed Earth at a nominal miss distance of 10.9 LD. Minimum miss distance 10.9 LD. See: 1998 WT24 - SSA , 1998 WT24 - JPL See also: http://neo.jpl.nasa.gov/images/1998wt24.html http://science.nasa.gov/science-news/science-at-nasa/2001/ast14dec_1/ http://www.jpl.nasa.gov/news/news.php?feature=4800 https://en.wikipedia.org/wiki/(33342)_1998_WT24 See also: 16 Dec 1908, 16 Dec 1956, 16 Dec 2001, 18 Dec 2099
2015, Dec 11	A. Olech, P. Źołądek, M. Wiśniewski, et al., 2015, <i>Monthly Notices of the Royal Astronomical Society</i>, 454, 2965, "PF131010 Ciechanów fireball: the body possibly related to near earth asteroids 2010 TB54 and 2010 SX11." See: http://adsabs.harvard.edu/abs/2015MNRAS.454.2965O
2015, Dec 13	Apollo NEA 2015 YJ ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.18 LD. [2015-26] See: 2015 YJ - SSA , 2015 YJ - JPL See also: 24 May 2055.
2015, Dec 14-18	American Geophysical Union Fall Meeting, session on Asteroids & Planetary Defense Session, San Francisco (CA, USA), 14-18 December 2015. See: http://fallmeeting.agu.org/2015/ https://agu.confex.com/agu/fm15/preliminaryview.cgi/Session7518 Among the papers: - M. Boslough, 2015, "Can plume-forming asteroid airbursts generate

	meteotsunami in deep water?" - M. Bruck Syal, 2015, "Deflection by kinetic impact or nuclear ablation: sensitivity to asteroid properties." - J.D. Burke, 2015, "Roadmap for an EA Earth Defense Initiative (READI)." - M. Busch, 2015, "Mission designs for demonstrating Gravity Tractor asteroid deflection." - J. Dotson, 2015, "Near Earth asteroid characteristics for asteroid threat assessment." - S.M. Ezzedine, 2015, "Numerical investigation of the consequences of land impacts, water impacts, or air bursts of asteroids." - M. Galiazzo, 2015, "V-type NEAs: impacts and close encounters with terrestrial planets." - P.M.M. Jenniskens, 2015, "An airborne observing campaign of an announced small asteroid impact for high fidelity impact modeling validation (Invited)." - E. Lindquist, 2015, "Characterization of NEOs from the policy perspective: implications from problem and solution definitions." - D.R. Ostrowski, 2015, "Planetary Defense and the high temperature physical properties of meteorites." - P. Roperch, 2015, "Paleomagnetism and mineralogy of unusual silicate glasses and baked soils on the surface of the Atacama Desert of Northern Chile: a major airburst impact ~12 ka ago?" - E.C. Sturkell, 2015, "The Lockne - Målingen doublet impacts, the result of a binary asteroid from the 470 Ma Main Asteroid Belt event."
2015, Dec 15	Asteroid 2015 XY261 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.75 LD. [2015-27] See: 2015 XY261 - SSA , 2015 XY261 - JPL
2015, Dec 21	M.R. Rampino, K. Caldeira, 2015, <i>Monthly Notices of the Royal Astronomical Society</i>, 454, 3480, "Periodic impact cratering and extinction events over the last 260 million years." See: http://adsabs.harvard.edu/abs/2015MNRAS.454.3480R
2015, Dec 21	N. Wang, Q.Y. Peng, X.L. Zhang, et al., 2015, <i>Monthly Notices of the Royal Astronomical Society</i>, 454, 3805, "Precise CCD positions of Apophis in 2013." See: http://adsabs.harvard.edu/abs/2015MNRAS.454.3805W
2015, Dec 23	T. Reyes, 2016, <i>Universe Today</i>, 23 December 2015, "We are not alone: government sensors shed new light on asteroid hazards." See: http://www.universetoday.com/116355/we-are-not-alone-government-sensors-shed-new-light-on-asteroid-hazards/

2015, Dec 24	Aten NEA 163899 (2003 SD220, $H = 17.9$ mag, $D \approx 1000$ m, PHA) passed Earth at a nominal miss distance of 28.4 LD. Minimum miss distance 28.4 LD. See: 2003 SD220 - SSA , 2003 SD220 - JPL See also: http://www.jpl.nasa.gov/news/news.php?feature=4807 https://en.wikipedia.org/wiki/(163899)_2003_SD220
2015, Dec 31	P. Michel, F. DeMeo, W. Bottke (eds.), 2015, ASTEROIDS IV, <i>Space Science Series</i> (University of Arizona Press, ISBN 978-0-8165-3213-1), "Surveys, astrometric follow-up & population statistics." See: http://www.uapress.arizona.edu/Books/bid2555.htm http://uapress.arizona.edu/extras/Michel_9780816532131_TOC.pdf See also: https://www.youtube.com/watch?v=IJDGD73aD9s Among the papers: - P.A. Abell, B.W. Barbee, P.W. Chodas, et al., 2015, p.855, "Human exploration of Near-Earth Asteroids". See: http://adsabs.harvard.edu/abs/2015aste.book..855A - E. Asphaug, G. Collins, M. Jutzi, 2015, p.661, "Global-scale impacts." See: http://adsabs.harvard.edu/abs/2015aste.book..661A - M.A. Barucci, M. Fulchignoni, J. Ji, et al., 2015, p.433 "The flybys of asteroids 2867 Steins, 21 Lutetia, and 4179 Toutatis". See: http://adsabs.harvard.edu/abs/2015aste.book..433B - L.A.M. Benner, M.W. Busch, J.D. Giorgini, P.A. Taylor, J.-L. Margot, 2015, p.165, "Radar observations of Near-Earth and Main-Belt asteroids". See: http://adsabs.harvard.edu/abs/2015aste.book..165B - R.P. Binzel, V. Reddy, T.L. Dunn, 2015, p.243, "The Near-Earth Object population: connections to comets, main-belt asteroids, and meteorites." See: http://adsabs.harvard.edu/abs/2015aste.book..243B - J. Borovička, P. Spurný, P. Brown, 2015, p.257, "Small Near-Earth Asteroids as a source of meteorites". See: http://adsabs.harvard.edu/abs/2015aste.book..257B - D. Farnocchia, S.R. Chesley, A. Milani, et al., 2015, p.815, "Orbits, long-term predictions, and impact monitoring." See: http://adsabs.harvard.edu/abs/2015aste.book..815F - A.W. Harris, M. Boslough, C.R. Chapman, L. Drube, P. Michel, A.W. Harris, 2015, p.835, "Asteroid impacts and modern civilization: can we prevent a catastrophe?" See: http://adsabs.harvard.edu/abs/2015aste.book..835H - R. Jedicke, M. Granvik, M. Micheli, et al., 2015, p.795, "Surveys, astrometric follow-up, and population statistics." See: http://adsabs.harvard.edu/abs/2015aste.book..795J

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2016, Jan 1	13504 NEAs known (ranging in size from a few meters up to ~ 37 km: 1036 Ganymed, 1924 TD, $H = 9.45$ mag, $D = 36.5$ km), of which 1638 PHAs (ranging in size from 140 m up to ~5 km: 4179 Toutatis, 1989 AC, $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, PHA). See: http://neo.jpl.nasa.gov/stats/
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2016, Jan	S. Chesley, A. Morbidelli, R. Jedicke, D. Farnocchia (eds.), 2016, Proceedings IAU Symposium No. 318 – Asteroids: New Observations, New Models, Honolulu, (Hawaii, USA) 3-14 August 2015 (Cambridge, CUP). See: 2015, Augustus 3-7.
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	SO2." See: http://adsabs.harvard.edu/abs/2016Ap%26SS.361...16D
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2016, Jan	A. Higuchi, S. Ida, 2016, <i>Astronomical Journal</i>, 151, 16, "Temporary capture of asteroids by a planet: dependence of prograde/retrograde capture on asteroids' semimajor axes." See: http://adsabs.harvard.edu/abs/2016AJ....151...16H
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2016, Jan	A.S. Rivkin, F. Marchis, J.A. Stansberry, et al., 2015, <i>Publications of the Astronomical Society of the Pacific</i>, 128, 018003, "Asteroids and the James Webb Space Telescope." See: http://adsabs.harvard.edu/abs/2016PASP..128a8003R
2016, Jan	V.V. Shuvalov, O.P. Popova, V.V. Svetsov, et al., 2016, <i>Solar System Research</i>, 50, 1, "Determination of the height of the 'meteoric explosion'. " See: http://adsabs.harvard.edu/abs/2016SoSyR..50....1S
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2016, Jan 1	D. Fulvio, D. Perna, S. Ieva, et al., 2016, <i>Monthly Notices of the Royal Astronomical Society</i>, 455, 584. "Spectral characterization of V-type asteroids - I. Space weathering effects and implications for V-

	type NEAs." See: http://adsabs.harvard.edu/abs/2016MNRAS.455..584F
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2016, Jan 6	Small Bodies Assessment Group (SBAG), 2016, "Goals and objectives for the exploration and investigation of the Solar System's small bodies." See: http://www.lpi.usra.edu/sbag/goals/GoalsDoc_ver.1.1.2016.pdf
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	394f http://www.lpi.usra.edu/sbag/meetings/jan2016/presentations/Johnson2.pdf
2016, Jan 10	Apollo NEA 2016 AQ164 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.27 LD. [2016-01] See: 2016 AQ164 - SSA , 2016 AQ164 - JPL
2016, Jan 12	Apollo NEA 2016 AH164 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.069 LD (= 4.18 R_{Earth} from the geocenter). Minimum miss distance 0.068 LD. [2016-02] See: 2016 AH164 - SSA , 2016 AH164 - JPL See also: 10 Jan 1992 .
2016, Jan 13	Apollo NEA 2016 AN165 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.47 LD. Minimum miss distance 0.47 LD. [2016-03] See: 2016 AN165 - SSA , 2016 AN165 - JPL See also: 12 Jan 1966 .
2016, Jan 14	Apollo NEA 2016 AN164 ($H = 30.5$ mag, $D \approx 2.8$ m) passed Earth at a nominal miss distance of 0.0964 LD (= 5.81 R_{Earth} from the geocenter). Minimum miss distance 0.0962 LD. [2016-04] See: 2016 AN164 - SSA , 2016 AN164 - JPL
2016, Jan 18	Apollo NEA 2018 BF3 ($H = 26.1$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 4.42 LD. Minimum miss distance 0.37 LD. See: 2018 BF3 - SSA , 2018 BF3 - JPL See also: 19 Jan 2018 .
2016, Jan 21	P. Senthil Kumar, U. Sruthi, N. Krishna, et al., 2016, <i>Journal of Geophysical Research: Planets</i> , 121, 147, "Recent shallow moonquake and impact-triggered boulder falls on the Moon : new insights from the Schrödinger basin." See: http://adsabs.harvard.edu/abs/2016JGRE..121..147S
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2016, Jan 26	Apollo NEA 2019 BV2 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 9.74 LD. Minimum miss distance 0.58 LD. See: 2019 BV2 - JPL , 2019 BV2 - SSA See also: 1 Aug 1954, 2 Aug 2064 .
2016, Jan 27 - 29	14th NASA Small Bodies Assessment Group Meeting , 27-29 Jan

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2016, Feb 25	Apollo NEA 2016 DY30 ($H = 30.7$ mag, $D \approx 2.5$ m) passed Earth at a nominal miss distance of 0.037 LD (= 2.25 R_{Earth} from the geocenter) . Minimum miss distance 0.037 LD. [2016-09] See: 2016 DY30 - SSA , 2016 DY30 - JPL See also: http://neo.ssa.esa.int/newsletters [June 2020]
2016, Feb 26	Apollo NEA 2016 DK2 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.83 LD. Minimum miss distance 0.82 LD. [2016-10] See: 2016 DK2 - SSA , 2016 DK2 - JPL
2016, Feb 29	Apollo NEA 2016 DA31 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.52 LD. [2016-11] See: 2016 DA31 - SSA , 2016 DA31 - JPL
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2016, Mar 1	ESA SSA-NEO Coordination Centre Newsletter, 1 March 2016. See: http://neo.ssa.esa.int/newsletters
2016, Mar 3, 05:17	Apollo NEA 2016 DV1 ($H = 24.9$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 1.03 LD. Minimum miss distance 1.03 LD. See: 2016 DV1 - SSA , 2016 DV1 - JPL
2016, Mar 3, 18:06	Apollo NEA 2016 EK1 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.53 LD. Minimum miss distance 0.53 LD. [2016-12] See: 2016 EK1 - SSA , 2016 EK1 - JPL
2016, Mar 4	Apollo NEA 2016 EL1 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.60 LD. Minimum miss distance 0.60 LD. [2016-13] See: 2016 EL1 - SSA , 2016 EL1 - JPL
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2016, Mar 8, 05:06	Apollo NEA 2016 EV28 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.40 LD. Minimum miss distance 0.40 LD. [2016-14] See: 2016 EV28 - SSA , 2016 EV28 - JPL
2016, Mar 10	Apollo NEA 2016 EN157 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a

	nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2016-15] See: 2016 EN157 - SSA , 2016 EN157 - JPL
2016, Mar 11	Apollo NEA 2016 EF195 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 0.082 LD (= 4.96 R_{Earth} from the geocenter). Minimum miss distance 0.082 LD. [2016-16] See: 2016 EF195 - SSA , 2016 EF195 - JPL See also: http://earthsky.org/space/asteroid-2016-ef195-detected-4-days-after-passing
2016, Mar 14	Apollo NEA 2016 FC1 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [2016-17] See: 2016 FC1 - SSA , 2016 FC1 - JPL
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2016, Mar 15	Apollo NEA 2018 SC ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.21 LD. Minimum miss distance 0.19 LD. [2016-18] See: 2018 SC - SSA , 2018 SC - JPL See also: http://iawn.net/ See also: 18 Sep 2018 .
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2016, Mar 17, 18:4	Impact on Jupiter , by asteroid or comet , observed by amateur astronomer G. Kernbauer (Mödling, Austria). See: http://us9.campaign-archive2.com/?u=0e9c23265f31e0f37201d19b6&id=431c55bb14&e=db8a8b6284 http://blog.asteroidday.org/2016/03/30/interview-with-gerrit-kernbauer-observing-an-impact-on-jupiter/ http://www.europlanet-eu.org/jupiter-blasted-by-6-5-fireball-impacts-per-year-on-average/

2016, Mar 21	Apollo NEA 2016 FN56 ($H = 24.3$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 1.01 LD. Minimum miss distance 0.94 LD. See: 2016 FN56 - SSA , 2016 FN56 - JPL
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2016, Mar 25	Apollo NEA 2016 FU6 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.47 LD. Minimum miss distance 0.46 LD. [2016-20] See: 2016 FU6 - SSA , 2016 FU6 - JPL See also: 24 March 1920.
2016, Mar 28	Apollo NEA 2016 FE15 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.70 LD. [2016-21] See: 2016 FE15 - SSA , 2016 FE15 - JPL
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2016, Apr 2	Apollo NEA 2019 UO8 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 1.94 LD. Minimum miss distance 0.25 LD. See: 2019 UO8 – SSA , 2019 UO8 - JPL See also: 25 Oct 2019 .
2016, Apr 4	Apollo NEA 2016 GN134 ($H = 30.5$ mag, $D \approx 2.8$ m) passed Earth at a nominal miss distance of 0.15 LD. Minimum miss distance 0.15 LD. [2016-23] See: 2016 GN134 - SSA , 2016 GN134 - JPL
2016, Apr 5	Apollo NEA 2016 FW13 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.82 LD. [2016-24] See: 2016 FW13 - SSA , 2016 FW13 - JPL See also: 8 Apr 2108 .
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2016, Apr 8	Apollo NEO 2016 GO134 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.86 LD. Minimum miss distance 0.86 LD. [2016-26] See: 2016 GO134 - SSA , 2016 GO134 - JPL
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2016, May 2	ESA SSA-NEO Coordination Centre Newsletter, 2 May 2016. See: http://neo.ssa.esa.int/newsletters
2016, May 5	Apollo NEA 2016 JS5 ($H = 30.7$ mag, $D \approx 2.5$ m) passed Earth at a nominal miss distance of 0.53 LD. Minimum miss distance 0.53 LD. [2016-27] See: 2016 JS5 - SSA , 2016 JS5 - JPL
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2016, Jun 2-5	<i>International Meteor Conference (IMC) 2016</i>, 2-5 June 2016, Egmond aan Zee (the Netherlands). See: http://imc2016.amsmeteors.org/ http://werkgroepmeteoren.nl/international-meteor-conference-2016-in-egmond-the-netherlands/ http://www.vallendesterren.info/international-meteor-conference-imc-2016-in-nederland/ Among the papers: - P. Jenniskens, 2016, "CAMS: results 2010-2015." See: http://imc2016.amsmeteors.org/program - P. Brown, 2016, "Recent Canadian Meteor Orbit Radar (CMOR) detected meteor shower outbursts." See: http://imc2016.amsmeteors.org/program
2016, Jun 3	<i>ESA SSA-NEO Coordination Centre Newsletter</i>, 3 June 2016. See: http://neo.ssa.esa.int/newsletters
2016, Jun 5	Apollo NEA 2016 LR51 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2016-28] See: 2016 LR51 - SSA , 2016 LR51 - JPL Discovery station: ... See: http://iawn.net/
2016, Jun 6-10	<i>Meteoroids 2016</i>, 6-10 June 2016, ESTeC, Noordwijk (the Netherlands). See: http://www.cosmos.esa.int/web/Meteoroids2016 Proceedings: D. Koschny, J. Borovička, D. Janches, I. P. Williams (eds.), 2017, <i>Planetary and Space Science</i>, Volume 143. Editorial: p. 1-2. Among the invited papers: - P. Brown, 2016, "Global detection and flux of superbolides." See: http://www.cosmos.esa.int/documents/653713/1000954/07_INVITED_Brown.pdf/5ee15bfe-2d10-439d-900d-abd522f25334 - P. Jenniskens, 2016, "Meteor showers in review." See: http://www.cosmos.esa.int/documents/653713/1000954/02_ORAL_Jenniskens.pdf/79ad75f5-58ed-4c73-ac89-47ad7f33f88d - P. Spurny, 2016, "Fireballs and meteorite falls." See: http://www.cosmos.esa.int/documents/653713/1000954/07_INVITED_Spurny.pdf/6694c0eb-10b4-4aca-a972-70e9ae78c351

	- O. Witasse, 2016, "Meteors on other planets." See: http://www.cosmos.esa.int/documents/653713/1000951/08_INVITED_Witasse.pdf/f266cead-2e3d-4ca1-ae0-fdf9d72ca2e8
2016, Jun 7	Apollo NEA 2016 LT1 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.38 LD. [2016-29] See: 2016LT1 - SSA , 2016 LT1 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2016, Jun 7	IAU, Division F, Working Group on Near Earth Objects, membership announced. See: https://www.iau.org/science/scientific_bodies/working_groups/171/ See also: https://www.iau.org/public/themes/neo/nea/
2016, Jun 8-17	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS), 59th session, Vienna (Austria), 8-17 June 2016. See: http://www.unoosa.org/oosa/en/ourwork/copuos/2016/index.html
2016, Jun 9	Apollo NEA 2016 LP10 ($H = 29.5$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2016-30] See: 2016LP10 - SSA , 2016 LP10 - JPL Discovery station: ... See: http://iawn.net/
2016, Jun 12	A. Glikson, 2016, <i>The Conversation</i>, 12 June 2016, "Ancient asteroid impacts yield evidence for the nature of the early Earth." See: https://theconversation.com/ancient-asteroid-impacts-yield-evidence-for-the-nature-of-the-early-earth-59675
2016, Jun 14	B. Schmitz, Q.-Z. Yin, M.E. Sanborn, et al., 2016, <i>Nature Communications</i>, 7, 11851, "A new type of solar-system material recovered from Ordovician marine limestone." See: http://www.nature.com/ncomms/2016/160614/ncomms11851/full/ncomms11851.html
2016, Jun 15	P. Michel, A. Cheng, M. Küppers, et al., 2016, <i>Advances in Space Research</i>, 57, 2529, "Science case for the Asteroid Impact Mission (AIM): a component of the Asteroid Impact & Deflection Assessment (AIDA) mission." See: http://adsabs.harvard.edu/abs/2016AdSpR..57.2529M

2016, Jun 15	P. Chodas, 2016, <i>JPL News</i>, 15 June 2016, "Small asteroid [2016 HO3] is Earth's constant companion." See: http://www.jpl.nasa.gov/news/news.php?feature=6537
2016, Jun 22	O. Doré, M.W. Werner, M. Ashby, et al., 2016, e-print <i>arXiv:1606.07039</i>, "Science impacts of the SPHEREx all-sky optical to near-infrared spectral survey: report of a community workshop examining extragalactic, galactic, stellar and planetary science." See: http://adsabs.harvard.edu/abs/2016arXiv160607039D
2016, Jun 22	S. Kohler, 2016, <i>AAS NOVA</i>, 22 June 2016, "Mapping Near-Earth hazards." See: http://aasnova.org/2016/06/22/mapping-near-earth-hazards/ See also: http://adsabs.harvard.edu/abs/2016AJ....151..172G
2016, Jun 27	H. Downes, 2016, <i>Press Release</i>, National Astronomy Meeting 2016, 27 June - 1 July 2016, Nottingham (U.K.), "Opal discovered in Antarctic meteorite". See: https://nam2016.org/press-releases/84-opal-discovered-in-antarctic-meteorite-ras-pr-16-31-nam-5-embargoed
2016, Jun 28-30	15th NASA Small Bodies Assessment Group Meeting, 28-30 June 2016, Laurel (MD, USA). See: http://www.lpi.usra.edu/sbag/ http://www.lpi.usra.edu/sbag/meetings/jun2016/draft_agenda_20160401.pdf Findings: https://www.lpi.usra.edu/sbag/findings/ Among the papers: - Lindley Johnson, 2016, "Review and discussion of SBAG 14 findings." See: http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/johnson.pdf - M. Gates, D. Mazanek, 2016, "Asteroid Redirect Mission (ARM)." See: http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/gates-mazanek.pdf - Y. Tsuda, M. Yoshikawa, 2016, "Hayabusa2." See: http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/Tsuda.pdf - L. Johnson, 2016, "Planetary Defense Coordination Office (PDCO) update." See: http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/johnson-neo.pdf See also: https://www.nasa.gov/planetarydefense/overview - D. Lauretta, 2016, "OSIRIS-REx." See: http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/Lauretta.pdf - E. Kramer, 2016, "NEOWISE." See:

	http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/kramer.pdf - I. Carnelli, 2016, " Asteroid Impact Mission (AIM) ." See: http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/carnelli.pdf - B. Barbee, M. Bruck Syal, G. Gisler, 2016, "NEA mitigation studies for short warning time scenarios." See: http://www.lpi.usra.edu/sbag/meetings/jun2016/presentations/barbee.pdf
2016, Jun 30	Asteroid Day . 30 June was proclaimed by the UN General Assembly as the annual International Asteroid Day , to raise public awareness about the asteroid impact hazard, the role of IAWN and SMPAG , UN-OOSA and UN-COPUOS member States in this area. See: http://www.asteroidday.org/ http://blog.asteroidday.org/2016/07/20/outstanding-participation-across-chile-second-asteroid-day/ See also: the seven-part video series "Scientists Rock - an Asteroid Day series": episode 1 , episode 2 , episode 3 , episode 4 , episode 5 , episode 6 , episode 7 See also: http://us9.campaign-archive2.com/?u=0e9c23265f31e0f37201d19b6&id=8471462384&e=db8a8b6284 http://us9.campaign-archive2.com/?u=0e9c23265f31e0f37201d19b6&id=8471462384&e=db8a8b6284
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2016, Jun-Jul	C. Rumpf, H.G. Lewis, P.M. Atkinson, 2016, <i>Acta Astronautica</i> , 123, 165, "On the influence of impact effect modelling for global asteroid impact risk distribution." See: http://adsabs.harvard.edu/abs/2016AcAau.123..165R
2016, Jul	D. Comelli, M. D'orazio, L. Folco, et al., 2016, <i>Meteorics & Planetary Science</i> , 51, 1301, "The meteoritic origin of Tutankhamun's iron dagger blade ." See: http://adsabs.harvard.edu/abs/2016M%26PS...51.1301C
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2016, Jul	M. Popescu, J. Licandro, D. Morate, et al., 2016, <i>Astronomy & Astrophysics</i> , 591, 115, "Near-infrared colors of minor planets recovered from VISTA-VHS survey (MOVIS)." See: http://adsabs.harvard.edu/abs/2016A%26A...591A.115P
2016, Jul 1	J. Sebera, A. Bezděk, I. Pešek, T. Henych, 2016, <i>Icarus</i> , 272, 70, "Spheroidal models of the exterior gravitational field of asteroids Bennu and Castalia ." See: http://adsabs.harvard.edu/abs/2016Icar..272...70S
2016, Jul 5	S.V. Petersen, A. Dutton, K.C. Lohmann, 2016, <i>Nature Communications</i> , 7, 12079, "End-Cretaceous extinction in Antarctica linked to both Deccan volcanism and meteorite impact via climate change." See: http://adsabs.harvard.edu/abs/2016NatCo...712079P See also: http://ns.umich.edu/new/releases/24010-warming-pulses-in-ancient-climate-record-link-volcanoes-asteroid-impact-and-dinosaur-killing-mass-extinction
2016, Jul 5	ESA SSA-NEO Coordination Centre Newsletter, 5 July 2016. See: http://neo.ssa.esa.int/newsletters
2016, Jul 7	Aten NEA 2016 NJ22 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.74 LD. Minimum miss distance 0.74 LD. [2016-31] See: 2016 NJ22 - SSA , 2016 NJ22 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 8 July 2141 .
2016, Jul 11	Apollo NEA 2016 NK22 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.69 LD. Minimum miss distance 0.69 LD. [2016-32] See: 2016 NK22 - SSA , 2016 NK22 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2016, Jul 11	A.V. Devyatkin, D.L. Gorshanov, V.N. Yershov, et al., 2016, <i>Monthly Notices of the Royal Astronomical Society</i> , 459, 3986, "A study of the asteroid (367943) Duende at Pulkovo Observatory." See: http://adsabs.harvard.edu/doi/10.1093/mnras/stw736
2016, Jul 15	D.M.H. Baker, J.W. Head, G.S. Collins, R.W.K. Potter, 2016, <i>Icarus</i> , 273, 146, "The formation of peak-ring basins: working hypotheses and path forward in using observations to constrain models of

	impact-basin formation." See: http://adsabs.harvard.edu/abs/2016Icar..273..146B
2016, Jul 19	D.S. Lauretta, 2019, <i>Scientific American</i>, 315, 62, "To Bennu and back - the seven-year mission to fetch 60 grams of asteroid." See: https://www.scientificamerican.com/article/to-bennu-and-back/
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2016, Jul 26	S. Marchi, A.I. Ermakov, C.A. Raymond, et al., 2016, <i>Nature Communications</i>, Volume 7, 12257, "The missing large impact craters on Ceres." See: http://adsabs.harvard.edu/abs/2016NatCo...712257M
2016, Jul 27	P. Murdin, 2016, <i>Rock Legends – the Asteroids and Their Discoverers</i> (Cham: Springer International Publishing). See: http://www.springer.com/us/book/9783319318356 See also: http://www.universetoday.com/131840/rock-legends-asteroids-discoverers/
2016, Jul 30 - Aug	COSPAR 41st Scientific Assembly 2016, 30 July - 7 August, Istanbul (Turkey) [cancelled]. Among the program: Past, present and future of small body science and exploration. See: http://cospar2016.tubitak.gov.tr/en/ - C. Raymond, R., Jaumann, G. Vane, et al., 2016, "Instruments for planetary exploration with CubeSats and SmallSats." See: http://adsabs.harvard.edu/abs/2016cosp...41E1632R
2016, Aug	D. Farnocchia, S.R. Chesley, P.G. Brown, P.W. Chodas, 2016, <i>Icarus</i>, 274, 327, "The trajectory and atmospheric impact of asteroid 2014 AA." See: http://adsabs.harvard.edu/abs/2016Icar..274..327F
2016, Aug	J. Hanuš, M. Delbo', D. Vokrouhlický, et al., 2016, <i>Astronomy & Astrophysics</i>, 592, 34, "Orbital, spin state and thermophysical characterization of near-Earth asteroid (3200) Phaethon." See: http://adsabs.harvard.edu/abs/2016A%26A...592A..34H
2016, Aug	S. He, Z. Zhu, C. Peng, 2016, <i>Acta Mechanica Sinica</i>, 32, 753, "Optimal design of Near-Earth Asteroid sample-return trajectories in the Sun-Earth-Moon system." See: http://adsabs.harvard.edu/abs/2016AcMSn..32..753H

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2016, Aug 1	ESA SSA-NEO Coordination Centre Newsletter, 1 August 2016. See: http://neo.ssa.esa.int/newsletters
2016, Aug 7-12	79th Annual Meeting of the Meteoritical Society , 7-12 August 2016, Berlin (Germany). See: http://www.meteoriticalsociety.org/?page_id=18 Among the papers: - K.L. Bryson, D.R. Ostrowski, 2016, <i>LPI Contribution</i> No. 1921, id.6483, "Meteorite fractures and scaling for asteroid atmospheric entry." See: http://adsabs.harvard.edu/abs/2016LPICo1921.6483B - D. Krispin, A.A. Mardon, B.G. Fawcett, 2016, <i>LPI Contribution</i> No. 1921, id.6560, "Historical uses of meteoritic metals as precedent for modern in-situ asteroid mining." See: http://adsabs.harvard.edu/abs/2016LPICo1921.6560K - C. E. Moyano-Camero, J. M. Trigo-Rodríguez, Eva Pellicer, et al., 2016, <i>LPI Contribution</i> No. 1921, id.6477, "UV-NIR spectra and nanoindentation of Chelyabinsk to infer the mechanical properties of hazardous asteroids." See: http://adsabs.harvard.edu/abs/2016LPICo1921.6477M - E.J. Speyerer, R.V. Wagner, R.Z. Povilaitis, et al., 2016, <i>LPI Contribution</i> No. 1921, id.6539, "Significance of new impact events on the Lunar surface." See: http://adsabs.harvard.edu/abs/2016LPICo1921.6539S - S. Voropaev, A. Korochantsev, D. Petukhov, et al., 2016, <i>LPI Contribution</i> No. 1921, id.6059, "Ordinary chondrites of Chelyabinsk meteorite and comparison with asteroid 25143 (Itokawa) ." See: http://adsabs.harvard.edu/abs/2016LPICo1921.6059V - H. Yabuta, A. Nakato, M. Komatsu, et al., 2016, <i>LPI Contribution</i> No. 1921, id.6525, "Scientific strategy of landing site selection for Hayabusa2 ." See: http://adsabs.harvard.edu/abs/2016LPICo1921.6525Y
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	astronomical body in a close distance flyby." See: http://adsabs.harvard.edu/abs/2016AdSpR..58..528A
2016, Aug 15	D.C. Agle, 2016, <i>JPL News</i>, 15 August 2016, "NASA Asteroid Redirect Mission completes design milestone." See: http://www.jpl.nasa.gov/news/news.php?feature=6593 http://www.jpl.nasa.gov/news/news.php?feature=6626
2016, Aug 23	Apollo NEA 2016 QY84 ($H = 29.6$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 3.25 LD. Minimum miss distance 0 LD. See: 2016 QY84 – S2P , 2016 QY84 – JPL
2016, Aug 23-24	<i>Second International Workshop on Asteroid Threat Assessment: Asteroid-generated Tsunami (AGT) and Associated Risk Assessment</i>, Seattle (WA, USA), 23-24 August. See: https://tsunami-workshop.arc.nasa.gov/workshop2016/ Summary Report (final 12 October 2016): https://tsunami-workshop.arc.nasa.gov/workshop2016/doc/AGTWorkshopSummaryfinal.pdf Guest Speaker: - V.V. Titov (NOAA), "Tsunami generation and propagation from asteroid impact simulations." Summary: - D. Morrison, E. Venkatapathy, 2017, <i>NASA/Technical Memorandum</i> (NASA/TM-219463) 2017, "Asteroid Generated Tsunami: Summary of NASA/NOAA Workshop." See: https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20170005214.pdf Among the papers: - M. Boslough, 2016, "Computational modeling of airbursts for asteroid-generated tsunami." - L. Johnson, 2016, "NASA PE, Planetary Defense and NEO Program." - D. Mathias, L. Wheeler, D. Aftosmis, et al., 2016, "Ensemble asteroid threat characterization: water versus land impacts." - D.K. Robertson, 2016, "Tsunami generation from asteroid airburst and ocean impact, and Van Dorn Effect." - L.D. Wheeler, D. Mathias, P. Register, 2016, "Analytical tsunami models for physics-based impact risk assessment."
2016, Aug 28	Aten NEA 2016 QA2 ($H = 25.3$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.23 LD. [2016-33] See: 2016 QA2 - SSA , 2016 QA2 - JPL Discovery station: SONEAR Observatory, Oliveira See: http://iawn.net/

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2016, Aug 31	P. Voosen, 2016, <i>Science</i> , 353, 974, "NASA to launch asteroid-sampling mission." See: http://adsabs.harvard.edu/abs/2016Sci...353..974V
2016, Aug 31	V. Zuccarelli, D. Bancelin, S. Weikert, et al., 2016, in: Proc. 6th International Association for the Advancement of Space Safety (IAASS) Conference "Safety is not an Option" , Montreal (Canada), 21-23 May 2013, e-print <i>arXiv:1608.08816</i> , " NEOPROP : a NEO propagator for Space Situational Awareness." See: http://adsabs.harvard.edu/abs/2016arXiv160808816Z http://iaassconference2013.space-safety.org/ http://iaassconference2013.space-safety.org/wp-content/uploads/sites/19/2013/06/0900_zuccarelli.pdf
2016, Sep	T. Nimura, T. Ebisuzaki, S. Maruyama, 2016, <i>Gondwana Research</i> , 37, 301, "End- Cretaceous cooling and mass extinction driven by a dark cloud encounter." See: http://adsabs.harvard.edu/abs/2016arXiv160306136N See also: http://astrobiology.com/2016/03/end-cretaceous-cooling-and-mass-extinction-driven-by-a-dark-cloud-encounter.html
2016, Sep	C.R. Nugent, A. Mainzer, J. Bauer, et al., 2016, <i>Astronomical Journal</i> , 152, 63, " NEOWISE reactivation mission year two: asteroid

	diameters and albedos." See: http://adsabs.harvard.edu/abs/2016AJ....152...63N
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2016, Sep 1	ESA SSA-NEO Coordination Centre Newsletter, 1 September 2016. See: http://neo.ssa.esa.int/newsletters
2016, Sep 2	R. Skibba, 2016, <i>Nature News</i> , 2 September 2016, " OSIRIS-REx spacecraft blazes trail for asteroid miners." See: https://www.nature.com/news/osiris-rex-spacecraft-blazes-trail-for-asteroid-miners-1.20486
2016, Sep 2	Apollo NEA 2016 RR1 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2016-34] See: 2016 RR1 - SSA , 2016 RR1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2016, Sep 3	Apollo NEA 2016 RS1 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.49 LD. [2016-35] See: 2016 RS1 - SSA , 2016 RS1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2016, Sep 7	Aten NEA 2016 RB1 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a

	nominal miss distance of 0.105 LD (= 6.35 R_{Earth} from the geocenter). Minimum miss distance 0.105 LD. [2016-36] See: 2016 RB1 - SSA , 2016 RB1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: http://neo.ssa.esa.int/news-archive [9 September 2016], http://www.jpl.nasa.gov/news/news.php?feature=6615 See also: 10 Sep 1947, 8 Sep 2078.
2016, Sep 8	Launch of NASA spacecraft Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer (OSIRIS-REx), an asteroid sample return mission. Target asteroid 101955 (1999 RQ36 = Bennu, H = 20.8 mag, D ≈ 575 m, NEO, PHA). The 2,110-kg spacecraft will launch aboard an Atlas V 411 rocket during a 34-day launch period that begins Sept. 8, and reach its asteroid target in 2018. After a careful survey of Bennu to characterize the asteroid and locate the most promising sample sites, OSIRIS-REx will collect between 60 to 2,000 grams of surface material with its robotic arm and return the sample to Earth via a detachable capsule on 24 September 2023. See: http://www.nasa.gov/osiris-rex http://science.nasa.gov/missions/osiris-rex/ http://www.asteroidmission.org/objectives/ http://www.nasa.gov/topics/solarsystem/features/osiris-rex.html http://www.nasa.gov/mission_pages/osiris-rex/index.html http://pirlwww.lpl.arizona.edu/~guym/OSIRIS-REx.pdf http://www.space.com/11802-nasa-asteroid-mission-dangerous-1999-rq36.html http://www.space.com/11808-nasa-asteroid-mission-osiris-rex-1999-rq36-infographic.html http://www.space.com/12065-osiris-rex-asteroid-generations.html http://web.mit.edu/newsoffice/2011/asteroid-mission-0726.html http://www.theithacajournal.com/article/20110828/NEWS01/108280327/Campus-Watch-Ithaca-College-professor-receives-NASA-grant-asteroid-study?odyssey=nav%7Chead http://www.space.com/13132-potentially-killer-asteroids-earth-nasa.html http://www.nasa.gov/press/2014/april/construction-to-begin-on-nasa-spacecraft-set-to-visit-asteroid-in-2018/ http://adsabs.harvard.edu/abs/2016Sci...353..974V http://iopscience.iop.org/article/10.1088/2058-7058/29/10/11/meta https://www.kqed.org/science/2017/09/29/why-is-nasa-checking-out-this-asteroid/ See also: 29 Dec 2009.
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2016, Sep 21	Apollo NEA 2016 SJ ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2016-38] See: 2016 SJ - SSA , 2016 SJ - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2016, Sep 24	Aten NEA 2016 SU2 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2016-39] See: 2016 SU2 - SSA , 2016 SU2 - JPL

	Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 27 Sep 2139.
2016, Sep 25	Apollo NEA 2016 SA2 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.80 LD. [2016-40] See: 2016 SA2 - SSA , 2016 SA2 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 22 Sep 2067.
2016, Sep 26	Apollo NEA 2016 SW3 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 1.002 LD. Minimum miss distance 1.001 LD. See: 2016 SW3 - SSA , 2016 SW3 - JPL
2016, Sep 26	SBAG Special Action Team Report, 2016, "ARM connections to priority small body science and exploration goals." See: http://www.lpi.usra.edu/sbag/documents/ARM-SAT-2016-09-26.pdf See also: http://www.spacedaily.com/reports/Report_Confirms_Scientific_Benefits_of_NASAs_Asteroid_Redirect_Mission_999.html
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2016, Sep 30	Apollo NEA 2016 TD ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.59 LD. [2016-41] See: 2016 TD - SSA , 2016 TD - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/

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2016, Oct 5	ESA SSA-NEO Coordination Centre Newsletter, 5 October 2016. See: http://neo.ssa.esa.int/newsletters
2016, Oct 8	Apollo NEA 2016 TG94 ($H = 29.9$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.56 LD. Minimum miss distance 0.56 LD. [2016-43] See: 2016 TG94 - SSA , 2016 TG94 - JPL Discovery station: ... See: http://iawn.net/
2016, Oct 10	Apollo NEA 2016 TS54 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.20 LD. Minimum miss distance 0.19 LD. [2016-44] See: 2016 TS54 - SSA , 2016 TS54 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2016, Oct 11	Apollo NEA 2016 TB19 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.82 LD. [2016-45] See: 2016 TB19 - SSA , 2016 TB19 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2016, Oct 25	B612 Foundation, <i>Annual Progress Report</i>, Volume Two, 2016, "Engaging the world in planetary defense." See: https://b612foundation.org/b612s-progress-report-vol-1-engaging-the-world-in-planetary-defense-2/? Summary: " - The 2008 [US] Congressionally mandated goal of finding 90% of NEOs larger than 140 meters is within reach. We believe this goal can be reached because of the full federal funding for the Large Synoptic Survey Telescope (LSST) in addition to potential NASA funding of the NEOCam infrared space telescope, wich B612 advocates. Because of this progress, it is our intention to package our research on Sentinel as a design reference mission for solar orbiting infrared space telescopes so that other scientists can benefit from our findings. - We are investigating a promising new technology called synthetic tracking that could allow us to address asteroids smaller than 140 meters. - Impending huge improvements in observing capabilities will lead to

	a deluge of new asteroid discoveries, and, in response, we are developing the Asteroid Decision Analysis Machine (ADAM), a more capable and open system for understanding, analyzing, and assessing impact and detection scenarios. - The second annual Asteroid Day this past June 30th was an international success, with the UN considering for it to be an officially recognized day, and we are preparing for a bigger and better Asteroid Day 2017. " See also: http://uk.blastingnews.com/tech/2016/11/b612-foundation-tracks-dangerous-neos-asteroids-with-new-technology-001274217.html https://b612foundation.org/asteroid-institute-announces-google-cloud-and-agi-among-new-technology-partners/
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2016, Nov 2	Fireball over Pennsylvania . The American Meteor Society received 311 reports so far about of a fireball event over seen over Pennsylvania on November 1st, 2016 around 08:15pm EDT (Nov. 2nd ~ 00:15 UT). The fireball was seen primarily from Pennsylvania but witnesses from Maryland, New York, Connecticut, Ohio, Virginia, West Virginia, Michigan, Massachusetts, Delaware and

	Ontario (Canada) also reported the event. See: http://www.amsmeteors.org/2016/11/fireball-over-pennsylvania/
2016, Nov 2	Aten NEA 2016 VA ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.24 LD. [2016-47] See: 2016 VA - SSA , 2016 VA - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 2 Nov 1938, 1 Nov 2024.
2016, Nov 3	ESA SSA-NEO Coordination Centre Newsletter, 3 November 2016. See: http://neo.ssa.esa.int/newsletters
2016, Nov 4	NASA and FEMA conduct asteroid impact emergency planning exercise. See: https://www.nasa.gov/feature/jpl/nasa-and-fema-conduct-asteroid-impact-emergency-planning-exercise http://mashable.com/2016/12/04/what-happens-killer-asteroid-strike/#dnM8PF3x5OqC
2016, Nov 7, 15:47	Apollo NEA 2019 VA ($H = 28.4$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 3.59 LD. Minimum miss distance 0.11 LD. See: 2019 VA – SSA , 2019 VA - JPL See also: 2 Nov 2019.
2016, Nov 7, 15:57	Aten NEA 2016 VB1 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.70 LD. [2016-48] See: 2016 VB1 – SSA , 2016 VB1 – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2016, Nov 10	Apollo NEA 2016 VF18 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.18 LD. Minimum miss distance 0.16 LD. [2016-49] See: 2016 VF18 - SSA , 2016 VF18 - JPL Discovery station: ... See: http://iawn.net/
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2016, Nov 17	Apollo NEA 2016 WT ($H = 29.9$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.50 LD. [2016-50] See: 2016 WT - SSA , 2016 WT - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2016, Nov 25	Apollo NEA 2016 WW2 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.35 LD. Minimum miss distance 0.35 LD. [2016-52] See: 2016 WW2 - SSA , 2016 WW2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2016, Nov 30	Apollo NEA 2016 XL23 ($H = 29.5$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.23 LD. [2016-53] See: 2016 XL23 - SSA , 2016 XL23 - JPL Discovery station: ... See: http://iawn.net/
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2016, Dec 12-16	<i>Asteroids & Planetary Defense press conferences at the American Geophysical Union Fall Meeting</i>, 12-16 December 2016, San Francisco (CA, USA). See: https://fallmeeting.agu.org/2016/ Sessions: - P31E : Update on results from the IODP-ICDP Chicxulub Impact Crater drilling expedition. - NH12A, NH13A : Defending the home planet. See: http://fallmeeting.agu.org/2016/media-center/press-conferences/#defense Among those: J. Nuth, 2016, "Comets have largely been ignored by people that are interested in defending the planet,". See also: http://www.space.com/35008-comet-strike-danger-to-earth.html https://www.theguardian.com/science/2016/dec/13/space-asteroid-comet-nasa-rocket http://www.smithsonianmag.com/science-nature/how-threat-getting-hit-asteroid-could-spur-international-collaboration-180961543/
2016, Dec 15	D. Lewis, 2016, <i>Smithsonian.com</i>, 15 December 2016, "Never fear, an oceanic asteroid impact wouldn't cause apocalyptic tidal waves." See: http://www.smithsonianmag.com/smart-news/asteroid-impact-ocean-wouldnt-cause-apocalyptic-tidal-waves-180961451/
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	LD. See: 2019 WC5 – SSA , 2019 WC5 – JPL
2017, Jan 9, 12:50	Aten NEA 2017 AG13 ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 0.54 LD. Minimum miss distance 0.54 LD. [2017-01] See: 2017 AG13 - SSA , 2017 AG13 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: http://www.astronomy.com/news/2017/01/aten-asteroid-close-to-earth See also: 9 Jan 2069.
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	See: 2017 BH30 - SSA , 2017 BH30 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
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2017, Feb 7	Apollo NEA 2017 BQ6 ($H = 21.7$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 6.56 LD. Minimum miss distance 6.56 LD. See: 2017 BQ6 - SSA , 2017 BQ6 - JPL See also: http://www.jpl.nasa.gov/news/news.php?feature=6742 https://en.wikipedia.org/wiki/2017_BQ6
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2017, Feb 17	Apollo NEA 2016 WF9 ($H = 20.3$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 133 LD (= 0.341 AU). Minimum miss distance 132 LD (= 0.340 AU). See: 2016 WF9 - SSA , 2016 WF9 - JPL See also: http://www.jpl.nasa.gov/news/news.php?feature=6712 https://en.wikipedia.org/wiki/2016_WF9
2017, Feb 18	Aten NEA 2017 DC36 ($H = 22.2$ mag, $D \approx 130$ m) passed Earth at a nominal miss distance of 4.23 LD. Minimum miss distance 4.23 LD. See: 2017 DC36 – SSA , 2017 DC36 – JPL
2017, Feb 23, 19:46	Apollo NEA 2017 DZ37 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 1.006 LD. Minimum miss distance 1.003 LD. See: 2017 DZ37 - SSA , 2017 DZ37 - JPL
2017, Feb 23, 21:08	Apollo NEA 2017 DG16 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.36 LD. Minimum miss distance 0.36 LD. [2017-05] See: 2017 DG16 - SSA , 2017 DG16 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2017, Feb 24	Aten NEA 5604 (1992 FE), ($H = 17.6$ mag, $D \approx 970$ m, PHA) passed Earth at a nominal miss distance of 13.07 LD. Minimum miss distance 13.07 LD. See: 1992 FE - SSA , 1992 FE - JPL See also: https://en.wikipedia.org/wiki/(5604)_1992_FE
2017, Feb 25	Apollo NEA 2017 DR34 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.58 LD. [2017-06] See: 2017 DR34 - SSA , 2017 DR34 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 26 Feb 2105.
2017, Feb 27	Apollo NEA 2017 DV36 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 1.02 LD. Minimum miss distance 1.02 LD.

	See: 2017 DV36 - SSA , 2017 DV36 - JPL
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2017, Mar 2	ESA SSA-NEO Coordination Centre Newsletter, 2 March 2017. See: http://neo.ssa.esa.int/newsletters
2017, Mar 2	Apollo NEA 2017 EA ($H = 31.0$ mag, $D \approx 2.3$ m) passed Earth at a nominal miss distance of 0.054 LD (= 3.28 R_{Earth} = 20,897 km from the geocenter). Minimum miss distance 0.054 LD. See: 2017 EA - SSA , 2017 EA - JPL [2017-07] Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: http://cneos.jpl.nasa.gov/news/news194.html
2017, Mar 5	Apollo NEA 2017 DS109 ($H = 26.2$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.92 LD. [2017-08] See: 2017 DS109 - SSA , 2017 DS109 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
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2017, Mar 17 14:10	Apollo NEA 2017 FW158 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.32 LD. Minimum miss distance 0.32 LD. [2017-09] See: 2017 FW158 - SSA , 2017 FW158 - JPL Discovery station: ... See: http://iawn.net/
2017, Mar 17 14:28	Apollo NEA 2017 FD3 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.47 LD. Minimum miss distance 0.47 LD. [2017-10] See: 2017 FD3 - SSA , 2017 FD3 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2017, Mar 19	Apollo NEA 2017 FS ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2017-11] See: 2017 FS - SSA , 2017 FS - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2017, Mar 20, 02:11	Apollo NEA 2017 FX158 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.71 LD. Minimum miss distance 0.70 LD. [2017-12] See: 2017 FX158 - SSA , 2017 FX158 - JPL Discovery station: ... See: http://iawn.net/
2017, Mar 20, 21:01	Apollo NEA 2017 FN1 ($H = 30.7$ mag, $D \approx 2.6$ m) passed Earth at a nominal miss distance of 0.16 LD. Minimum miss distance 0.16 LD. [2017-13] See: 2017 FN1 - SSA , 2017 FN1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/

2017, Mar 20, 22:3	Apollo NEA 2017 FM1 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.33 LD. Minimum miss distance 0.33 LD. [2017-14] See: 2017 FM1 - SSA , 2017 FM1 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2017, Mar 20-24	Science with the Hubble and James Webb Space Telescopes. V, Venice (Italy), 20-24 March 2017. See: http://www.stsci.edu/institute/conference/hst5
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2017, Apr 3	Asteroid 2017 FT102 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 1.05 LD. Minimum miss distance 1.05 LD. See: 2017 FT102 - SSA , 2017 FT102 - JPL
2017, Apr 4	Apollo NEA 2017 GM ($H = 29.9$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.042 LD (= $2.55 R_{\text{Earth}} = 16,267$ km from the geocenter). Minimum miss distance 0.042 LD. [2017-17] See: 2017 GM - SSA , 2017 GM - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: https://cneos.jpl.nasa.gov/news/news195.html See also: http://neo.ssa.esa.int/newsletters [June 2020]
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2017, Apr 19	Apollo NEA 2014 JO25 ($H = 17.8$ mag, $D \approx 1000$ m, PHA) passed Earth at a nominal miss distance of 4.57 LD. Minimum miss distance 4.57 LD. See: 2014 JO25 - SSA , 2014 JO25 - JPL See also: https://www.jpl.nasa.gov/news/news.php?feature=6807 https://www.jpl.nasa.gov/news/news.php?feature=6817 https://www.nasa.gov/feature/jpl/nasa-radar-spots-relatively-large-asteroid-prior-to-flyby http://earthsky.org/space/asteroid-2014-jo25-looks-like-comet-67pchuryumov-gerasimenko https://cneos.jpl.nasa.gov/news/news196.html https://www.bloomberg.com/view/articles/2017-05-11/an-asteroid-may-kill-us-all-congress-is-pinching-pennies http://adsabs.harvard.edu/abs/2017DPS....4911702V https://en.wikipedia.org/wiki/2014_JO25
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2017, Sep 18	Apollo NEA 2020 CD3 ($H = 31.7$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.52 LD. [2017-31] See: 2020 CD3 – S2P , 2020 CD3 – JPL See also: 6 Dec 2017, 19 Feb 2018, 9 May 2018, 9 Aug 2018, 26 Oct 2018, 16 Jan 2019, 4 Apr 2019, 30 Jun 2019, 10 Sep 2019, 18 Nov 2019, 13 Feb 2020.
2017, Sep 20	ISAS/JAXA, 2017, "DESTINY+: technology demonstration and exploration of asteroid 3200 Phaethon." See: http://fanfun.jaxa.jp/jaxatv/files/20170920_dlr_e.pdf
2017, Sep 20, 07:34	Apollo NEA 2017 SM2 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.81 LD. Minimum miss distance 0.81 LD. [2017-32] See: 2017 SM2 - SSA , 2017 SM2 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/ See also: https://www.cnet.com/news/asteroids-near-earth-2012-tc4-2017-space/
2017, Sep 20, 15:49	Apollo NEA 2017 SZ32 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.53 LD. Minimum miss distance 0.53 LD. [2017-33]

	See: 2017 SZ32 - SSA , 2017 SZ32 - JPL Discovery station: ... See: http://iawn.net/
2017, Sep 20, 20:29	Apollo NEA 2017 SR2 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.24 LD. Minimum miss distance 0.24 LD. [2017-34] See: 2017 SR2 - SSA , 2017 SR2 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: https://www.cnet.com/news/asteroids-near-earth-2012-tc4-2017-space/
2017, Sep 21	T.G.G. Chanut, S. Aljbaae, A.F.B.A. Prado, V. Carruba, 2017, <i>Monthly Notices of the Royal Astronomical Society</i>, 470, 2687, "Dynamics in the vicinity of (101955) Bennu: solar radiation pressure effects in equatorial orbits." See: http://adsabs.harvard.edu/abs/2017MNRAS.470.2687C
2017, Sep 21	Bright fireball over The Netherlands, Belgium, Germany, France and UK, at $\sim 21:00$ hr. See: http://fireball.imo.net/members/imo_view/event/2017/3301 http://werksgroepmeteoren.nl/heldere-vuurbol-donderdag-21-september-2017/ http://neo.ssa.esa.int/news-archive
2017, Sep 24, 08:12	Apollo NEA 2017 SU17 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.72 LD. [2017-35] See: 2017 SU17 - SSA , 2017 SU17 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2017, Sep 24, 15:32	Apollo NEA 2017 SS12 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.67 LD. Minimum miss distance 0.67 LD. [2017-36] See: 2017 SS12 - SSA , 2017 SS12 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 26 Sep 2066.
2017, Sep 25	J. Tuttle Keane, 2017, <i>Nature Geoscience</i>, 10, 716, "Sketch-up: impact-induced subduction." See: http://www.nature.com/ngeo/journal/v10/n10/pdf/ngeo3039.pdf
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	<i>Geoscience</i>, 10, 793, "Impact-driven subduction on the Hadean Earth." See: http://adsabs.harvard.edu/abs/2017NatGe..10..793O
2017, Sep 29	Apollo NEA 496817 (1989 VB), $H = 20.1$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 7.87 LD. Minimum miss distance 7.87 LD. See: 1989 VB - SSA, 1989 VB - JPL See also: 13 Oct 1956, 20 Oct 2078.
2017, Sep 30	Apollo NEA 2017 TQ2 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.27 LD. [2017-37] See: 2017 TQ2 - SSA, 2017 TQ2 - JPL Discovery station: ... See: http://iawn.net/
2017, Oct	M.G. Daly, O.S. Barnouin, C. Dickinson, et al., 2017, <i>Space Science Reviews</i>, 212, 899, "The OSIRIS-REx Laser Altimeter (OLA), investigation and instrument." See: http://adsabs.harvard.edu/abs/2017SSRv..212..899D
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2017, Oct	A.H. Peslier, M. Schönbächler, H. Busemann, S.-I. Karato, 2017, <i>Space Science Reviews</i> , 212, 743, "Water in the Earth's interior: distribution and origin." See: http://adsabs.harvard.edu/abs/2017SSRv..212..743P Erratum: http://adsabs.harvard.edu/abs/2017SSRv..212..811P
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2017, Oct 2	B.K.D. Pearce, R.E. Pudritz, D.A. Semenov, T.K. Henning, 2017, <i>Proceedings of the National Academy of Sciences of the United States of America</i> , published ahead of print 2 October, 2017, "Origin of the RNA world: the fate of nucleobases in warm little ponds." See: http://www.pnas.org/content/early/2017/09/26/1710339114.abstract?sid=50304da0-c66a-46ac-9dfa-ee01c3e91c22 See also: http://dailynews.mcmaster.ca/article/meteorites-may-have-brought-building-blocks-of-life-to-earth/ https://www.sciencealert.com/meteorites-and-warm-ponds-may-have-

	birthed-the-earliest-life-on-earth
2017, Oct 2	Apollo NEA 2017 SX17 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.23 LD. [2017-38] See: 2017 SX17 - SSA , 2017 SX17 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 2 Oct 2124.
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2017, Oct 4	ESA SSA-NEO Coordination Centre Newsletter, 4 October 2017. See: http://neo.ssa.esa.int/newsletters
2017, Oct 9-11	3rd International Focus Workshop on Near Earth Objects: opportunities and risks, 9-11 October 2017, San Donato in Poggio (Firenze, Italia). [cancelled] See: http://chiantitopics.it/
2017, Oct 10	Apollo NEA 2017 TF5 ($H = 25.4$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.72 LD. [2017-39] See: 2017 TF5 - SSA , 2017 TF5 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2017, Oct 12	Apollo NEA 2012 TC4 ($H = 26.7$ mag, $D \approx 15 \times 8$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.13 LD. [2017-40] See: 2012 TC4 - SSA , 2012 TC4 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: https://cneos.jpl.nasa.gov/news/news197.html https://www.jpl.nasa.gov/news/news.php?feature=6906 https://www.nasa.gov/feature/jpl/asteroid-flyby-will-benefit-nasa-detection-and-tracking-network http://2012tc4.astro.umd.edu/ http://www.esa.int/spaceinimages/Images/2017/08/Asteroid_2012_TC4_will_fly_past_Earth_in_October_2017 https://www.inverse.com/article/37130-nasa-asteroid-armageddon http://www.skyandtelescope.com/astronomy-blogs/astronomy-space-david-dickinson/asteroid-2012-tc4-set-to-zip-past-the-earth-on-thursday https://www.jpl.nasa.gov/news/news.php?feature=6969 http://neo.ssa.esa.int/news-archive https://www.jpl.nasa.gov/news/news.php?feature=6994 https://en.wikipedia.org/wiki/2012_TC4 See also: 11 Oct 1986, 12 Oct 2012.
2017, Oct 14	Hyperbolic interstellar asteroid 'Oumuamua (1I/2017 U1, $H = 22.01$ mag, $D \approx 400 \times 40$ m) passed Earth at a nominal miss distance of 0.162 au (= 62.90 LD). Minimum miss distance 0.162 au (= 62.89 LD). The object approached from the direction of the constellation Lyra at 25.5 km/s, and departed in the direction of the constellation Pegasus at 44 km/s relative to the Sun. See: 2017 U1 - SSA , 2017 U1 - JPL See also: http://www.skyandtelescope.com/astronomy-news/astronomers-spot-first-known-interstellar-comet/ https://www.jpl.nasa.gov/news/news.php?feature=6983 https://www.eso.org/public/archives/releases/sciencepapers/eso1737/eso1737a.pdf https://www.minorplanetcenter.net/mpec/K17/K17V17.html http://www.skyandtelescope.com/astronomy-news/update-on-interstellar-object-oumuamua/ https://www.iau.org/news/announcements/detail/ann17045/

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2017, Oct 15	F. Damme, H. Hussmann, J. Oberst, 2017, <i>Planetary and Space Science</i> , 146, 1, "Spacecraft orbit lifetime within two binary near-Earth asteroid systems." See: http://adsabs.harvard.edu/abs/2017P%26SS..146....1D
2017, Oct 15, 03:23	Apollo NEA 2017 UF ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2017-41] See: 2017 UF - SSA , 2017 UF - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2017, Oct 15, 06:18	Apollo NEA 2017 UK52 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 6.54 LD. Minimum miss distance 0.26 LD. See: 2017 UK52 - SSA , 2017 UK52 - JPL
2017, Oct 15-20	49th Annual AAS Division for Planetary Sciences Meeting , 15-20 October 2017, Provo (UT, USA). See: https://aas.org/meetings/dps49 https://aas.org/meetings/dps49/events Among the papers: - C. Avdellidou, D. Koschny, NELIOTA team, 2017, AAS DPS meeting #49, id.#204.08, "Lunar impact flashes - tracing the NEO size distribution." See: http://adsabs.harvard.edu/abs/2017DPS....4920408A - M.A. Barucci, D. Perna, S. Fornasier, et al., 2017, AAS DPS meeting #49, id.#110.08, " NEOShield-2 project: final results on compositional characterization of small NEOs."

	See: http://adsabs.harvard.edu/abs/2017DPS....4911008B - C. Benson, D.J. Scheeres, N. Moskovitz, 2017, <i>AAS DPS meeting</i> #49, id.#117.05, "Asteroid (367943) 2012 DA14 flyby spin state analysis." See: http://adsabs.harvard.edu/abs/2017DPS....4911705B - R.P. Binzel, F.E. DeMeo, C. Lantz, et al., 2017, <i>AAS DPS meeting</i> #49, id.#110.09, "Do Near-Earth Asteroids and meteorite falls share the same source regions?" See: http://adsabs.harvard.edu/abs/2017DPS....4911009B - J. Blacksberg, S.R. Chesley, B. Ehlmann, C.A. Raymond, 2017, <i>AAS DPS meeting</i> #49, id.#219.22, "Intrepid: exploring the NEA population with a fleet of highly autonomous SmallSat explorers." See: http://adsabs.harvard.edu/abs/2017DPS....4921922B - W. Bottke, S. Mazrouei, R. Ghent, A. Parker, 2017, <i>AAS DPS meeting</i> #49, id.#100.03, "What really happened to Earth's older craters?" See: http://adsabs.harvard.edu/abs/2017DPS....4910003B - M. Brozovic, L.A.M. Benner, S.P. Naidu, Shantanu P., et al., 2017, <i>AAS DPS meeting</i> #49, id.#204.01, "Goldstone radar images of near-Earth asteroids (469896) 2007 WV4, 2014 JO25, 2017 BQ6, and 2017 CS." See: http://adsabs.harvard.edu/abs/2017DPS....4920401B - M. Brucker, R.S. McMillan, T. Bressi, et al., 2017, <i>AAS DPS meeting</i> #49, id.#112.08, "Update on Spacewatch observations of Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2017DPS....4911208B - S.R. Chesley, G.M. Hockney, M.J. Holman, 2017, <i>AAS DPS meeting</i> #49, id.112.14, "Introducing ADES: a new IAU astrometry data exchange standard." See: http://adsabs.harvard.edu/abs/2017DPS....4911214C - B.E. Clark, V.E. Hamilton, J.P. Emery, et al., 2017, <i>AAS DPS meeting</i> #49, id.#110.01, "Spectral apping at asteroid 101955 Bennu." See: http://adsabs.harvard.edu/abs/2017DPS....4911001C - J. Emery, B. Rozitis, P.R. Christensen, et al., 2017, <i>AAS DPS meeting</i> #49, id.#110.02, "Thermophysical analysis of 101955 Bennu with OSIRIS-REx." See: http://adsabs.harvard.edu/abs/2017DPS....4911002E - N. Erasmus, M. Mommert, D.E. Trilling, et al., 2017, <i>AAS DPS meeting</i> #49, id.#204.05, "Rapid-response characterization of Near-Earth Asteroids using KMTNet-SAAO." See: http://adsabs.harvard.edu/abs/2017DPS....4920405E - D. Farnocchia, D.J. Tholen, M. Micheli, et al., 2017 <i>AAS DPS meeting</i> #49, id.#100.09, "Mass estimate and close approaches of near-Earth asteroid 2015 TC25." See: http://adsabs.harvard.edu/abs/2017DPS....4910009F - D. Fohring, D.J. Tholen, Z. Claytor, et al., 2017, <i>AAS DPS meeting</i>

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	meeting #49, id.#204.04, "The Mission Accessible Near-Earth Object Survey (MANOS): project status." See: http://adsabs.harvard.edu/abs/2017DPS....4920404M - N. Myhrvold, 2017, AAS <i>DPS meeting</i> #49, id.#117.06, "An empirical examination of WISE/NEOWISE asteroid analysis and results." See: http://adsabs.harvard.edu/abs/2017DPS....4911706M - S.P. Naidu, S.R. Chesley, D. Farnocchia, 2017, AAS <i>DPS meeting</i> #49, id.#112.04, "Near-Earth Object survey simulation software." See: http://adsabs.harvard.edu/abs/2017DPS....4911204N - S. Navarro-Meza, M. Mommert, D.E. Trilling, et al., 2017, AAS <i>DPS meeting</i> #49, id.#117.04, "First results from the rapid-response spectrophotometric characterization of Near-Earth objects using RATIR." See: http://adsabs.harvard.edu/abs/2017DPS....4911704N - C.T. Nugent, J. Dailey, R.M. Cutri, et al., 2017, AAS <i>DPS meeting</i> #49, id.#103.03, "Machine learning and next-generation asteroid surveys." See: http://adsabs.harvard.edu/abs/2017DPS....4910303N - V. Reddy, O. Kuhn, A. Thirouin, et al., 2017, AAS <i>DPS meeting</i> #49, id.#204.07, "Ground-based characterization of Earth quasi satellite (469219) 2016 HO3." See: http://adsabs.harvard.edu/abs/2017DPS....4920407R See also: https://phys.org/news/2017-10-earth-buddy-asteroid-space-junk.html - E.G. Rivera-Valentin, P.A. Taylor, A. Virkki, et al., 2017, AAS <i>DPS meeting</i> #49, id.#112.09, "Arecibo radar observations of Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/2017DPS....4911209R - D. Robertson, E. Stern, D. Mathias, 2017, AAS <i>DPS meeting</i> #49, id.#106.01, "Ground hazards from 100 - 300 m asteroid impacts." See: http://adsabs.harvard.edu/abs/2017DPS....4910601R - W. Ryan, E.V. Ryan, 2017, AAS <i>DPS meeting</i> #49, id.#204.06, "Spin state of returning fly-by Near Earth Asteroid 2012 TC4." See: http://adsabs.harvard.edu/abs/2017DPS....4920406R - J. Silva, F., Monteiro, F. Tamayo, 2017, AAS <i>DPS meeting</i> #49, id.#110.38, "Model shape and spin direction of the asteroid 2011 UW158." See: http://adsabs.harvard.edu/abs/2017DPS....4911038S - F. Spoto, P. Tanga, A. Del Vigna, et al., 2017, AAS <i>DPS meeting</i> #49, id.103.06, "Short arc orbit determination and Gaia alerts." See: http://adsabs.harvard.edu/abs/2017DPS....4910306S - D. Takir, C.A. Hibbitts, L. Le Corre, et al., 2017, AAS <i>DPS meeting</i> #49, id.#219.07, "Hayabusa2 NIRS3's investigation to characterize and select sampling and landing sites on asteroid (25143) Ryugu." See: http://adsabs.harvard.edu/abs/2017DPS....4921907T - P.A. Taylor, A. Virkki, B. Warner, Brian, et al., 2017, AAS <i>DPS</i>

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2017, Oct 16	Apollo NEA 2017 TH5 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.26 LD. Minimum miss distance 0.26 LD. [2017-42] See: 2017 TH5 - SSA , 2017 TH5 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2017, Oct 17	D. Stolte, 2017, <i>UA News</i>, 17 October 2017, "Earth's new buddy is asteroid, not space junk." See: https://uanews.arizona.edu/story/earths-new-buddy-asteroid-not-space-junk
2017, Oct 17	Apollo NEA 2017 UR2 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.83 LD. Minimum miss distance 0.83 LD. [2017-43] See: 2017 UR2 - SSA , 2017 UR2 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/ See also: 16 Oct 2004, 21 Oct 2119.
2017, Oct 19	A.W. Harris, More Data!, 2017, <i>Phys.Org News</i>, 19 October 2017, "Number of undiscovered near-Earth asteroids revised downward."

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2017, Oct 19	D. Remy, E. Lu, 2017, <i>B612 blog</i> , "Asteroids and why we need to map the inner Solar System." See: https://b612foundation.org/asteroids-and-why-we-need-to-map-the-inner-solar-system/ https://drive.google.com/file/d/0B4HHj1a0sWMiRl9EbWJENUJaU2s/view https://www.ft.com/content/8aef03d6-7b5b-11e7-ab01-a13271d1ee9c
2017, Oct 19	Apollo NEA 2017 TD6 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.50 LD. [2017-44] See: 2017 TD6 - SSA , 2017 TD6 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2017, Oct 20, 07:38	Aten NEA 2017 UL52 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 4.01 LD. Minimum miss distance 0 LD. See: 2017 UL52 - SSA , 2017 UL52 - JPL
2017, Oct 20, 14:07	Apollo NEA 2017 UJ2 ($H = 31.0$ mag, $D \approx 2.2$ m) passed Earth at a nominal miss distance of 0.047 LD (= 2.81 R_{Earth} from the geocenter). Minimum miss distance 0.046 LD. [2017-45] See: 2017 UJ2 - SSA , 2017 UJ2 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 20 Oct 1978, 30 Oct 2030. See also: http://neo.ssa.esa.int/newsletters [June 2020]
2017, Oct 21	Apollo NEA 2017 UA52 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.51 LD. Minimum miss distance 0.50 LD. [2017-46] See: 2017 UA52 - SSA , 2017 UA52 - JPL Discovery station: ... See: http://iawn.net/
2017, Oct 23	D. Clery, 2017, <i>Science News</i> , 23 October 2017, "NASA weighs trimming WFIRST to hold down costs." See: http://www.sciencemag.org/news/2017/10/nasa-weighs-trimming-wfirst-hold-down-costs
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2017, Oct 28	Apollo NEA 2017 UL6 ($H = 32.1$ mag, $D \approx 1.4$ m) passed Earth at a nominal miss distance of 0.16 LD. Minimum miss distance 0.15 LD. [2017-47] See: 2017 UL6 - SSA , 2017 UL6 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2017, Oct 30	Apollo NEA 2017 UK8 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.59 LD. [2017-48] See: 2017 UK8- SSA , 2017 UK8 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2017, Oct 31	C. Münker, R.O.C. Fonseca, T. Schulz, 2017, <i>Nature Geoscience</i> , 10, 822, "Silicate Earth's missing niobium may have been sequestered into asteroidal cores." See: http://adsabs.harvard.edu/abs/2017NatGe..10..822M
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2017, Nov 3	<i>ESA SSA-NEO Coordination Centre Newsletter</i> , 3 November 2017. See: http://neo.ssa.esa.int/newsletters
2017, Nov 4	Apollo NEA 2017 VE ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.88 LD. [2017-49] See: 2017 VE - SSA , 2017 VE - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/ See also: 5 Nov 2090 .
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2017, Nov 9	Apollo NEA 2017 VL2 ($H = 26.0$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 0.31 LD. Minimum miss distance 0.31 LD. [2017-50] See: 2017 VL2- SSA , 2017 VL2- JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
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2017, Nov 13	Apollo NEA 2017 VF14 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.79 LD. [2017-51] See: 2017 VF14 - SSA , 2017 VF14 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2017, Nov 13-15	Workshop on Planning Solar System Observations with JWST, 13-15 November, STScI, Baltimore (MD, USA). See: http://www.cvent.com/d/d5q602
2017, Nov 15	G. Anglada, P.J. Amado, J.L. Ortiz, et al., 2017, <i>Astrophysical Journal Letters</i>, 850, L6, "ALMA discovery of dust belts around Proxima Centauri." See: http://adsabs.harvard.edu/abs/2017ApJ...850L...6A See also: http://www.eso.org/public/unitedkingdom/news/eso1735/?lang
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2017, Nov 21 19:18	Apollo NEA 2017 WW1 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.37 LD. Minimum miss distance 0.37 LD. [2017-52] See: 2017 WW1- SSA , 2017 WW1- JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2017, Nov 21 19:53	Apollo NEA 2017 WA14 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.25 LD. [2017-53] See: 2017 WA14 - SSA , 2017 WA14 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 25 Nov 2098 .
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2017, Dec 18, 00:21	Apollo NEA 2017 YH1 ($H = 21.4$ mag, $D \approx 190$ m, PHA) passed Earth at a nominal miss distance of 2.39 LD. Minimum miss distance 2.38 LD. See: 2017 YH1 - SSA , 2017 YH1 - JPL
2017, Dec 18, 03:51	Apollo NEA 2017 YJ1 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 1.04 LD. Minimum miss distance 1.04 LD. See: 2017 YJ1 - SSA , 2017 YJ1 - JPL
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2018, Jan 15	Apollo NEA 2018 BW ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2018-02] See: 2018 BW - SSA , 2018 BW - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
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2018, Jan 16	Apollo NEA 2018 BR1 ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2018-03] See: 2018 BR1 - SSA , 2018 BR1 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
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2018, Jan 18 15:43	Apollo NEA 2018 BD ($H = 30.2$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.102 LD. Minimum miss distance 0.101 LD. [2018-04] See: 2018 BD - SSA , 2018 BD - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ https://www.cnet.com/news/asteroid-2018-bd-earth-potentially-hazardous-2002-aj129/ See also: 20 Jan 2031.

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2018, Jan 19 03:00	Apollo NEA 2018 BF3 ($H = 26.1$ mag, $D \approx 22$ m) passed Earth at a nominal miss distance of 0.63 LD. Minimum miss distance 0.63 LD. [2018-05] See: 2018 BF3 - SSA , 2018 BF3 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 18 Jan 2016 .
2018, Jan 19 20:23	Apollo NEA 2018 BC ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.73 LD. [2018-06] See: 2018 BC - SSA , 2018 BC - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2018, Jan 19 23:00	Aten NEA 2018 BX ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.73 LD. [2018-07] See: 2018 BX - SSA , 2018 BX - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 19 Jan 2068 .
2018, Jan 20	Apollo NEA 2018 BL11 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.79 LD. Minimum miss distance 0.79 LD. [2018-08] See: 2018 BL11 - SSA , 2018 BL11 - JPL Discovery station: ... See: http://iawn.net/
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2018, Feb 4, 14:50	Apollo NEA 2018 CS1 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.90 LD. Minimum miss distance 0.89 LD. [2018-10] See: 2018 CS1 - SSA , 2018 CS1 - JPL Discovery station: Catalina Sky Survey

	See: http://iawn.net/
2018, Feb 4, 21:31	Apollo NEA 276033 (2002 AJ129, $H = 19.1$ mag, $D \approx 500$ m, PHA) passed Earth at a nominal miss distance of 10.95 LD. Minimum miss distance 10.95 LD. Mercury crossing asteroid. See: 2002 AJ129 - SSA , 2002 AJ129 - JPL See also: https://www.jpl.nasa.gov/news/news.php?feature=7042 https://en.wikipedia.org/wiki/(276033)_2002_AJ129
2018, Feb 6, 19:16	Apollo NEA 2018 CF2 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.25 LD. [2018-11] See: 2018 CF2 - SSA , 2018 CF2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Feb 6, 20:12	Apollo NEA 2018 CC ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2018-12] See: 2018 CC - SSA , 2018 CC - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: https://www.jpl.nasa.gov/news/news.php?feature=7055 http://earthsky.org/space/asteroids-feb-2018-cb-and-2018-cc-online-viewing See also: 8 Feb 2034.
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2018, Feb 9, 07:26	Apollo NEA 2018 CN2 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.18 LD. Minimum miss distance 0.18 LD. [2018-13] See: 2018 CN2 - SSA , 2018 CN2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 8 Feb 1935, 9 Feb 2088.
2018, Feb 9, 22:29	Apollo NEA 2018 CB ($H = 26.0$ mag, $D \approx 23$ m) passed Earth at a nominal miss distance of 0.18 LD. Minimum miss distance 0.18 LD. [2018-14] See: 2018 CB - SSA , 2018 CB - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: https://www.jpl.nasa.gov/news/news.php?feature=7055 http://earthsky.org/space/asteroids-feb-2018-cb-and-2018-cc-online-viewing https://www.livescience.com/61713-asteroid-flyby-late-notice.html
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2018, Feb 15	Apollo NEA 2018 CD3 ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.92 LD. [2018-15] See: 2018 CD3 - SSA , 2018 CD3 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2018, Feb 19	Apollo NEA 2020 CD3 ($H = 31.7$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.58 LD. [2018-16] See: 2020 CD3 – S2P , 2020 CD3 – JPL See also: 18 Sep 2017, 6 Dec 2017, 9 May 2018, 9 Aug 2018, 26 Oct 2018, 16 Jan 2019, 4 Apr 2019, 30 Jun 2019, 10 Sep 2019, 18 Nov 2019, 13 Feb 2020.
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2018, Feb 21	G. Borderes-Motta, O.C.Winter, 2018, <i>Monthly Notices of the Royal Astronomical Society</i>, 474, 2452, "Poincaré surfaces of section around a 3D irregular body: the case of asteroid 4179 Toutatis." See: http://adsabs.harvard.edu/abs/2018MNRAS.474.2452B
2018, Feb 21	Apollo NEA 2018 DQ ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.26 LD. Minimum miss distance 0.26 LD. [2018-17] See: 2018 DQ - SSA , 2018 DQ - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/

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2018, Feb 23	P.A. Dybczyński, M. Królikowska, 2018, <i>Astronomy & Astrophysics</i> , 610, L11, "Investigating the dynamical history of the interstellar object ' Oumuamua '?" See: http://adsabs.harvard.edu/abs/2018A%26A...610L..11D
2018, Feb 24	Apollo NEA 2018 DN4 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.55 LD. Minimum miss distance 0.018 LD (= 1.06 R_{Earth} from the geocenter) . [2018-18] See: 2018 DN4 - SSA , 2018 DN4 - JPL Discovery station: ... See: http://iawn.net/
2018, Feb 25	Apollo NEA 2018 DU ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.74 LD. Minimum miss distance 0.74 LD. [2018-19] See: 2018 DU - SSA , 2018 DU - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 24 Feb 2032 .
2018, Feb 27	T. Prusti, 2018, <i>Europhysics News</i> , 49, 29, " Gaia : science with 1 billion objects in three dimensions." See: http://adsabs.harvard.edu/abs/2018ENews..49...29P
2018, Feb 27- Mrt 1	Deep Space Gateway Concept Science Workshop , 27 February - 1 March 2018, Denver (CO, USA). See: https://www.hou.usra.edu/meetings/deepspace2018/ In the Proceedings: - L. Keszthelyi, L.Gaddis, B. Archinal, et al., 2018, <i>LPI Contribution No. 2063</i> , id.3116, "Using the Deep Space Gateway to map resources and defend Earth ." See: http://adsabs.harvard.edu/abs/2018LPICo2063.3116K - R.R. Landis, L.D. Graham, 2018, <i>LPI Contribution No. 2063</i> , id.3152, "Poor man's asteroid sample return missions." See: http://adsabs.harvard.edu/abs/2018LPICo2063.3152L - M. Shao, S. Turyshev, C. Zhai, et al., 2018, <i>LPI Contribution No. 2063</i> , id.3020, "Search for Near-Earth Objects from the Deep Space Gateway ." See: http://adsabs.harvard.edu/abs/2018LPICo2063.3020S
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2018, Feb 28	NASA Near-Earth Object Camera (NEOCam) , a study for an infrared survey telescope optimized for meeting US congressional mandate to find and characterize NEOs down to 140 meters in size, continues in extended Phase A, and passed Systems Requirements Review / Mission Definition Review on February 28, 2018. See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/fast.pdf
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2018, Mar	D. Kuroda, M. Ishiguro, M. Watanabe, et al., 2018, <i>Astronomy & Astrophysics</i> , 611, 31, "Significantly high polarization degree of the very low-albedo asteroid (152679) 1998 KU2 ." See: http://adsabs.harvard.edu/abs/2018A%26A...611A..31K
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	the Chelyabinsk and Tunguska space body impacts." See: http://adsabs.harvard.edu/abs/2018SoSyR..52..129S
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2018, Mar 2	Aten NEA 2018 DV1 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.29 LD. Minimum miss distance 0.29 LD. [2018-20] See: 2018 DV1 - SSA , 2018 DV1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Mar 3-10	2018 IEEE Aerospace Conference , 3-10 March 2018, Big Sky (Montana, USA). See: http://www.aeroconf.org/ Notably: - Session 2.12 on "Asteroid detection, characterization, sample-return, and deflection", chaired by M. Boslough, P. Chodas and J. Webster. See: http://www.aeroconf.org/conference-organizers
2018, Mar 5	ESA SSA-NEO Coordination Centre Newsletter, 5 March 2018. See: http://neo.ssa.esa.int/newsletters
2018, Mar 5-9	ESO Workshop Diversis Mundi: the Solar System in an Exoplanetary Context , 5-9 March 2018, ESO, Santiago (Chile). See: http://www.eso.org/sci/meetings/2018/ops2018.html Among the Invited Papers: - K. Meech, 2018, "Water in small bodies of the Solar System."

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2018, Mar 7	Apollo NEA 2017 VR12 ($H = 20.6$ mag, $D \approx 260$ m, PHA) passed Earth at a nominal miss distance of 3.76 LD. Minimum miss distance 3.76 LD. See: 2017 VR12 - SSA , 2017 VR12 - JPL See also: https://echo.jpl.nasa.gov/asteroids/2017VR12/2017VR12_planning.2018.html https://en.wikipedia.org/wiki/2017_VR12 See also: 10 Mar 2079 . Ref: -Z.-J. Zhang, Y.-G. Zhang, X.-M. Chen, et al., 2019, <i>Research in Astronomy and Astrophysics</i> , 19, 071, "CCD astrometric observations of 2017 VR12, Camillo and Midas." See: http://adsabs.harvard.edu/abs/2019RAA....19..71Z
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2018, Mar 14	Apollo NEA 2018 EZ2 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.56 LD. Minimum miss distance 0.56 LD. [2018-21] See: 2018 EZ2 - SSA , 2018 EZ2 - JPL Discovery station: Siding Spring-Janess-G, JAXA See: http://iawn.net/
2018, Mar 15	E.S. Howell, C. Magri, R.J. Vervack, et al., 2017, <i>Icarus</i> , 303, 220, "SHERMAN - a shape-based thermophysical model. II. Application to 8567 (1996 HW1)."

	See: http://adsabs.harvard.edu/abs/2018Icar..303..220H
2018, Mar 15	R.L. Jones, C.T. Slater, J. Moeyens, et al., 2018, <i>Icarus</i> , 303, 181, "The Large Synoptic Survey Telescope as a Near-Earth Object discovery machine." See: http://adsabs.harvard.edu/abs/2018Icar..303..181J
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2018, Mar 17	Apollo NEA 2018 FL29 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.57 LD. [2018-22] See: 2018 FL29 - SSA , 2018 FL29 - JPL Discovery station: ... See: http://iawn.net/
2018, Mar 18	Aten NEA 2018 FE3 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.38 LD. [2018-23] See: 2018 FE3 - SSA , 2018 FE3 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 16 March 2067 .
2018, Mar 19	Apollo NEA 2018 FQ3 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.72 LD.

	[2018-24] See: 2018 FQ3 - SSA , 2018 FQ3 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2018, Mar 19-23	49th Lunar and Planetary Science Conference, 19-23 March 2018, The Woodlands (TX, USA). See: https://www.hou.usra.edu/meetings/lpsc2018/ Among the presentations: - Y. Aoki, H. Demura, N. Hirata, N. et al., 2018, <i>LPI Contribution</i> No. 2083, id.1857, "GUI retrieval of FOVs in HARMONICS for 2018 rendezvous of Hayabusa2." See: http://adsabs.harvard.edu/abs/2018LPI....49.1857A - T. Arai, M. Kobayashi, K. Ishibashi, et al., 2018, <i>LPI Contribution</i> No. 2083, id.2570, "DESTINY+ mission: flyby of Geminids parent asteroid (3200) Phaethon and in-situ analyses of dust accreting on the Earth." See: http://adsabs.harvard.edu/abs/2018LPI....49.2570A - T. Arai, S. Tanaka, T. Kouyama, et al., 2018, <i>LPI Contribution</i> No. 2083, id.1912, "thermal infrared imager onboard Hayabusa2 observes the thermophysical properties under the surface layer of the asteroid Ryugu." See: http://adsabs.harvard.edu/abs/2018LPI....49.1912A - O.S. Barnouin, N.L. Chabot, C.M. Ernst, et al., 2018, <i>LPI Contribution</i> No. 2083, id.1042, "The science proximity operations of the Double Asteroid Redirection Test mission." See: http://adsabs.harvard.edu/abs/2018LPI....49.1042B - W.F. Bottke, S. Mazrouei, R.R. Ghent, et al., 2018, <i>LPI Contribution</i> No. 2083, id.1457, "What really happened to Earth's older craters?" See: http://adsabs.harvard.edu/abs/2018LPI....49.1457B - T.H. Burbine, P.C. Buchanan, R.L. Klima, R.P. Binzel, 2018, <i>LPI Contribution</i> No. 2083, id.2712, "Can formulas derived from pyroxene and/or HED reflectance spectra be used to determine the mineralogies of V-Type NEAs?" See: http://adsabs.harvard.edu/abs/2018LPI....49.2712B - S. Cambioni, R. Malhotra, C.W. Hergenrother, et al., 2018, <i>LPI Contribution</i> No. 2083, id.1149, "An upper limit on Earth's Trojan Asteroid population from OSIRIS-REx." See: http://adsabs.harvard.edu/abs/2018LPI....49.1149C - E.A. Cloutis, D. Trang, P.G. Lucey, 2018, <i>LPI Contribution</i> No. 2083, id.1591, "The effect of opaque materials on spectral reflectance of the Cherokee Springs LL Chondrite: implications for asteroid Itokawa." See: http://adsabs.harvard.edu/abs/2018LPI....49.1591C - J.D. Dotson, L.F. Wheeler, D.L. Mathias, D. Farnocchia, 2018, <i>LPI Contribution</i> No. 2083, id.2944, "Risk assessment for 2012 TC4

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2018, Mar 23	Apollo NEA 2018 FZ3 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.50 LD. [2018-25] See: 2018 FZ3 - SSA , 2018 FZ3 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2018, Apr 18	Meeting of the SMPAG Legal Working Group, in the margins of the UN COPUOS Legal Subcommittee, 18 April 2018, Vienna (Austria). Report to appear at http://www.smpag.net
2018, Apr 21	Apollo NEA 2018 HW1 ($H = 25.8$ mag, $D \approx 25$ m) passed Earth at a nominal miss distance of 0.89 LD. Minimum miss distance 0.89 LD. [2018-31] See: 2018 HW1 - JPL , 2018 HW1 - SSA Discovery station: ... See: http://iawn.net/ See also: 19 Apr 1975, 24 Apr 2041.
2018, Apr 22	Apollo NEA 2018 HV ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.40 LD. Minimum miss distance 0.40 LD. [2018-32] See: 2018 HV - SSA , 2018 HV - JPL Discovery station: Mt. Lemmon Survey

	See: http://iawn.net/
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2018, May 2	D.J. Scheeres, P. Sánchez, 2018, <i>Progress in Earth and Planetary Science</i>, 5, 25, "Implications of cohesive strength in asteroid interiors and surfaces and its measurement." See: http://adsabs.harvard.edu/abs/2018PEPS....5...25S
2018, May 3	C. Zhai, M. Shao, S. Lai, et al., 2018, <i>JPL Publication</i> 18-1, e-print <i>arXiv</i>:1805.01102, "Technical Note: Asteroid detection demonstration from SkySat-3 B612 data using synthetic tracking." See: http://adsabs.harvard.edu/abs/2018arXiv180501102Z
2018, May 4	ESA SSA-NEO Coordination Centre Newsletter, 4 May 2018. See: http://neo.ssa.esa.int/newsletters
2018, May 7	M.J. Holman, M.J. Payne, P. Blankley, et al., 2018, e-print <i>arXiv</i>:1805.02638, "Finding asteroids down the back of the couch: a novel approach to the minor planet linking problem." See: http://adsabs.harvard.edu/abs/2018arXiv180502638H
2018, May 9	Apollo NEA 2020 CD3 ($H = 31.7$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.07 LD. Minimum miss distance 0.07 LD. [2018-33]

	See: 2020 CD3 – S2P , 2020 CD3 – JPL See also: 18 Sep 2017, 6 Dec 2017, 19 Feb 2018, 9 Aug 2018, 26 Oct 2018, 16 Jan 2019, 4 Apr 2019, 30 Jun 2019, 10 Sep 2019, 18 Nov 2019, 13 Feb 2020.
2018, May 14	J. Shewaga, 2018, <i>Phys.Org.News</i>, 14 May 2018, "Tracking the threat of asteroids and comets." See: https://phys.org/news/2018-05-tracking-threat-asteroids-comets.html
2018, May 14	J.L. Tonry, L. Denneau, A.N. Heinze, et al., 2018, <i>Publications of the Astronomical Society of the Pacific</i>, 130, 064505, "ATLAS: a high-cadence all-sky survey system." See: http://adsabs.harvard.edu/abs/2018PASP..130f4505T
2018, May 14	J.I. Zuluaga, O. Sanchez-Hernandez, M. Sucerquia, I. Ferrin, 2018, <i>Astrophysical Journal</i>, 155, 236, "A general method for assessing the origin of interstellar small bodies: the case of 1I/2017 U1 ('Oumuamua)." See: http://adsabs.harvard.edu/abs/2018AJ....155..236Z
2018, May 14 - Jun 8	Munich Institute for Astro-and Particle Physics (MIAPP) Workshop on Near-Earth Objects: Properties, Detection, Resources, Impacts and Defending Earth, 14 May - 8 June 2018, Munich (BRD). See: http://www.munich-iapp.de/programmes-topical-workshops/2018/near-earth-objects-properties-detection-resources-impacts-and-defending-earth/ Organizing Committee: A. Burkert, C. Colombo, R. Jedicke, D. Koschny, R. Wainscoat. Topics: - Dynamical structure of asteroid belt and NEO provenance - Science at asteroids - Space law - Asteroid mining - International coordination - Asteroid deflection - Science communication - Spacecraft missions - Impact and atmospheric effects - Interstellar objects as NEOs - Consequences and coordination of impact response - Asteroid astrometric and physical followup - Dynamics and impact monitoring - Physical properties of asteroids MIAPP Workshop report: See: https://www.cosmos.esa.int/documents/336356/1803543/ESA-SSA-NEO-HO-0371_1_0_MIAPP_report_2018-10-18.pdf

	See also: https://www.tum.de/nc/en/about-tum/news/press-releases/detail/article/34696/
2018, May 15	D. Hickson, A. Boivin, M.G. Daly, et al., 2018, <i>Icarus</i>, 306, 16, "Near surface bulk density estimates of NEAs from radar observations and permittivity measurements of powdered geologic material." See: http://adsabs.harvard.edu/abs/2018Icar..306...16H
2018, May 15	J. Kruk, <i>STScI Newsletters</i>, 35, Issue 1, "WFIRST mission update." See: http://www.stsci.edu/news/newsletters/pagecontent/institute-newsletters/2018-volume-35-issue-01/wfirst-mission-update.html See also: https://wfirst.gsfc.nasa.gov/why_wfirst.html https://www.space.com/wfirst.html [16 Jul 2019] https://www.space.com/nasa-wfirst-space-telescope-moves-forward.html/ [11 Sep 2019] https://www.jpl.nasa.gov/news/news.php?feature=7499 https://www.space.com/nasa-2021-budget-cuts-earth-science-telescopes-stem.html http://www.esa.int/ESA_Multimedia/Images/2020/04/James_Webb_Space_Telescope_s_primary_mirror_unfolded
2018, May 15	M.M. McAdam, J.M. Sunshine, K.T. Howard, et al., 2018, <i>Icarus</i>, 306, 32, "Spectral evidence for amorphous silicates in least-processed CO meteorites and their parent bodies." See: http://adsabs.harvard.edu/abs/2018Icar..306...32M
2018, May 15	M.M.M. Meier, L. Bindi, P.R. Heck, et al., 2018, <i>Earth and Planetary Science Letters</i>, 490, 122, "Cosmic history and a candidate parent asteroid for the quasicrystal-bearing meteorite Khatyrka." See: http://adsabs.harvard.edu/abs/2018E%26PSL.490..122M
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2018, May 15	Apollo NEA 2010 WC9 ($H = 23.8$ mag, $D \approx 60$ m) passed Earth at a nominal miss distance of 0.53 LD. Minimum miss distance 0.53 LD. [2018-34] See: 2010 WC9 - SSA , 2010 WC9 - JPL Discovery station: calculated See: http://iawn.net/ See also: 15 May 2102, 17 May 2156 See also: https://watchers.news/2018/05/10/asteroid-2010-wc9/

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2018, May 23	W.S. Cassata, B.E. Cohen, D.F. Mark, et al., 2018, <i>Science Advances</i>, 4, eaap8306, "Chronology of Martian breccia NWA 7034 and the formation of the Martian crustal dichotomy." See: http://advances.sciencemag.org/content/4/5/eaap8306 See also: https://www.llnl.gov/news/ancient-meteorite-tells-tales-mars-topography
2018, May 23	Apollo NEA 2018 KW1 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2018-35] See: 2018 KW1 - SSA , 2018 KW1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, May 24	R. Jedicke, B.T. Bolin, W.F. Bottke, et al., 2018, <i>Frontiers in Astronomy and Space Sciences</i>, 5, 13, "Earth's minimoons: opportunities for science and technology." See: http://adsabs.harvard.edu/abs/2018FrASS...5...13J See also: https://www.eurekalert.org/pub_releases/2018-08/f-emp081318.php https://www.space.com/41502-earth-has-minimoons-asteroid-science.html
2018, May 24	K.G. MacLeod, P.C. Quinton, J. Sepúlveda, M.H. Negra, 2018, <i>Science</i>, 24 May 2018, eaap8525, "Postimpact earliest Paleogene warming shown by fish debris oxygen isotopes (El Kef, Tunisia)." See: http://science.sciencemag.org/content/early/2018/05/24/science.aap8525 See also: https://www.space.com/40690-dino-killing-asteroid-impact-warmed-earth.html#?
2018, May 25	A. Mann, 2018, <i>Science</i>, 360, 842, "B612 plans asteroid hunt with fleet of small satellites." See: http://adsabs.harvard.edu/abs/2018Sci...360..842M

2018, May 26	Apollo NEA 2018 KY2 ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.78 LD. Minimum miss distance 0.78 LD. [2018-36] See: 2018 KY2 - SSA , 2018 KY2 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2018, May 29	S. Van wal, Y. Tsuda, K. Yoshikawa, et al., 2018, <i>Journal of Spacecraft and Rockets</i>, 55, 797, "Prearrival deployment analysis of rovers on Hayabusa2 asteroid explorer." See: http://adsabs.harvard.edu/abs/2018JSpRo..55..797V
2018, May 31	A. Drouard, P. Vernazza, S. Loehle, et al., 2018, <i>Astronomy & Astrophysics</i>, 613, 54, "Probing the use of spectroscopy to determine the meteoritic analogues of meteors." See: http://adsabs.harvard.edu/abs/2018A%26A...613A..54D
2018, Jun	Since June 2018, the IAU Minor Planet Center, directed by Matthew J. Holman, is operating under the NASA Planetary Data System's Small Bodies Node (SBN). The SBN serves as intermediary between the direction of the NASA Planetary Defense Coordination Office (PDCO) and the MPC. See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/fast.pdf
2018, Jun	M.C.F. Bazzocchi, M.R. Emami, 2018, <i>Journal of the Astronautical Sciences</i>, 65, 183, "Asteroid redirection mission evaluation using multiple landers." See: http://adsabs.harvard.edu/abs/2018JAnSc..65..183B
2018, Jun	D.V. Bisikalo, I.S. Savanov, S.A. Naroenkov, 2018, <i>Astronomy Reports</i>, 62, 367, "Perspectives for distributed observations of near-Earth space using a Russian-Cuban observatory." See: http://adsabs.harvard.edu/abs/2018ARep...62..367B
2018, Jun	B.L. de Vries, H. Skogby, L.B.F.M. Waters, M. Min, 2018, <i>Icarus</i>, 307, 400, "Laboratory mid-IR spectra of equilibrated and igneous meteorites. Searching for observables of planetesimal debris." See: http://adsabs.harvard.edu/abs/2018Icar..307..400D
2018, Jun	G.E. Sambarov, O.M. Syusina, 2018, <i>Russian Physics Journal</i>, 61, 373, "Analysis of probabilistic orbital evolution of the asteroids 2011 CQ1 and 2011 MD." See: http://adsabs.harvard.edu/doi/10.1007/s11182-018-1409-3
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	impactors in the Gaia era." See: http://adsabs.harvard.edu/abs/2018A%26A...614A..27S
2018, Jun	R.D. Tiwary, B.S. Kushvah, B. Ishwar, 2018, <i>Journal of Astrophysics and Astronomy</i>, 39, 29, "Trajectory of asteroid 2017 SB20 within the CRTBP." See: http://adsabs.harvard.edu/abs/2018JApA...39...29T
2018, Jun	B. Williams, P. Antreasian, E. Carranza, et al., 2018, <i>Space Science Reviews</i>, 214, 69, "OSIRIS-REx flight dynamics and navigation design." See: http://adsabs.harvard.edu/abs/2018SSRv..214...69W
2018, Jun 1	M.A. Barucci, D. Perna, M. Popescu, et al., 2018, <i>Monthly Notices of the Royal Astronomical Society</i>, 476, 4481, "Small D-type asteroids in the NEO population: new targets for space-missions." See: http://adsabs.harvard.edu/abs/2018MNRAS.476.4481B
2018, Jun 1	E. Tasker, 2018, <i>Nature Astronomy</i>, 2, 502, "Bringing home a piece of our past." See: http://adsabs.harvard.edu/abs/2018NatAs...2..502T
2018, Jun 1	Y. Qi, A. de Ruiter, 2018, <i>Monthly Notices of the Royal Astronomical Society</i>, 476, 5464, "Short-term capture of the Earth-Moon system." See: http://adsabs.harvard.edu/abs/2018MNRAS.476.5464Q
2018, Jun 2, 16:53	Impact. Apollo NEA 2018 LA ($H = 30.5$ mag, $D \approx 2.8$ m) approached Earth at a nominal miss distance of 0 LD. Minimum miss distance 0 LD. The object impacted the Earth atmosphere eight hours after discovery by the Catalina Sky Survey and disintegrated over Botswana, several miles above the surface, creating a bright fireball that lit up the evening sky. See: 2018 LA - SSA , 2018 LA - JPL Discovery station: Mt. Lemmon Survey See also: http://iawn.net/ See also: 6 June 1989. See also: https://www.jpl.nasa.gov/news/news.php?feature=7148 "The discovery of asteroid 2018 LA is only the third time that an asteroid has been discovered to be on an impact trajectory, said Paul Chodas, manager of the Center for Near-Earth Object Studies (CNEOS) at JPL. "It is also only the second time that the high probability of an impact was predicted well ahead of the event itself." See also: https://www.ifa.hawaii.edu/info/press-releases/ATLAS_2018LA/ https://b612foundation.org/watching-the-worldwide-asteroid-tracking-system-work-by-danica-remy/

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2018, Jun 3-7	<i>American Astronomical Society 232nd Meeting</i>, 3-7 June 2018, Denver (CO, USA). See: https://aas.org/meetings/aas232 Among the presentations: - A. Truitt, R. Weaver, G. Gisler, 2018, <i>AAS Meeting #232</i>, id.#119.06, "A parameter study on the effect of impactor size for NASA's DART mission." See: http://adsabs.harvard.edu/abs/2018AAS...23211906T
2018, Jun 5	A. Mann, 2018, <i>Proceedings of the National Academy of Sciences</i>, 115, 5820, "News Feature: Life after the asteroid apocalypse." See: http://www.pnas.org/content/115/23/5820
2018, Jun 5	ESA SSA-NEO Coordination Centre Newsletter, 5 June 2018. See: http://neo.ssa.esa.int/newsletters
2018, Jun 6	C. Funk, M. Srauss, 2018, <i>Pewinternet.org</i>, 6 June 2018, "Majority of Americans believe it is essential that the U.S. remain a global leader in space." See: http://www.pewinternet.org/2018/06/06/majority-of-americans-believe-it-is-essential-that-the-u-s-remain-a-global-leader-in-space/ See also: https://mailchi.mp/b612foundation/earth-day-784581?e=b8e2af394f
2018, Jun 8	P. Vereš, M.J. Payne, M.J. Holman, et al., 2018, <i>Astronomical Journal</i>, 156, 5, "Unconfirmed Near-Earth Asteroids." See: http://adsabs.harvard.edu/abs/2018AJ....156....5V See also: https://www.newscientist.com/article/2168844-weve-lost-track-of-more-than-900-near-earth-asteroids/
2018, Jun 10	Amor NEA 2018 EJ4 ($H = 21.4$ mag, $D \approx 190$ m, PHA) passed Earth at a nominal miss distance of 5.56 LD. Minimum miss distance 5.56 LD. See: 2018 EJ4 - SSA , 2018 EJ4 - JPL See also: 11 Jun 2197.
2018, Jun 11	T. Hoang, A. Loeb, A. Lazarian, J. Cho, 2018, <i>Astrophysical Journal</i>, 860, 42, "Spinup and disruption of interstellar asteroids by mechanical torques, and implications for 1I/2017 U1

	(Oumuamua)." See: http://adsabs.harvard.edu/abs/2018ApJ...860...42H
2018, Jun 11	F. Namouni, M.H.M. Morais, 2018, <i>Monthly Notices Royal Astronomical Society: Letters</i>, 477, L117, "An interstellar origin for Jupiter's retrograde co-orbital asteroid [514107 (2015 BZ509)]." See: http://adsabs.harvard.edu/abs/2018MNRAS.477L.117N See also: http://www.sciencemag.org/news/2018/05/asteroid-came-another-solar-system-and-it-s-here-stay https://www.space.com/40643-first-interstellar-immigrant-asteroid-jupiter-orbit.html? https://apod.nasa.gov/apod/astropix.html https://en.wikipedia.org/wiki/(514107)_2015_BZ509
2018, Jun 11	Amor NEA 2015 DP155 ($H = 21.7$ mag, $D \approx 160$ m, PHA) passed Earth at a nominal miss distance of 8.96 LD. Minimum miss distance 8.96 LD. See: 2015 DP155 - SSA , 2015 DP155 - JPL See also: 9 Jun 2080.
2018, Jun 12	B612 Newsletter, 12 June 2018, "Pew Poll shows public believes asteroid monitoring should be a top priority." See: https://b612foundation.org/pew-poll-shows-public-believes-asteroid-monitoring-should-be-a-top-priority/
2018, Jun 13	K. Hugo, 2018, <i>Newsweek</i>, 13 June 2018, "European Space Agency's 'Flyeye' telescope could spot asteroids before they destroy life on Earth." See: https://www.newsweek.com/telescope-mimics-fly-eyes-scan-sky-asteroids-974852 See also: http://www.esa.int/Safety_Security/ESA_s_bug-eyed_telescope_to_spot_risky_asteroids https://en.wikipedia.org/wiki/NEOSTEL
2018, Jun 13-14	NASA 19th Small Bodies Assessment Group Meeting, 13-14 June 2018, College Park (MD, USA). See: http://www.lpi.usra.edu/sbag/meetings/ Agenda: https://www.lpi.usra.edu/sbag/meetings/jun2018/index.shtml Findings: https://www.lpi.usra.edu/sbag/findings/ Among the presentations: - J.A.R. Rall, 2018, "Planetary Science Division overview." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/rall.pdf - T. Swindle, 2018, "SBAG preparation for the Decadal Survey." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/swindle.pdf

	- D.R. Adamo, 2018, "Revisited roles for Small Bodies in ISECG's Global Exploration Roadmap (GER)." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/adamo.pdf - T.S. Statler, 2018, "Common themes in planetary Small Bodies research (2018 update)." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/statler.pdf - K. Fast, 2018, "Near-Earth Object Observations Program." and L. Johnson, 2018, "Planetary Defense Coordination Office." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/fast.pdf See also: https://ac.arc.nasa.gov/pif3gqw4wu0y?proto=true - F. Vilas, 2018, "National Science Foundation Status for SBAG, June 2018." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/vilas.pdf - J. Nuth, 2018, "OSIRIS-REx update." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/nuth.pdf - A. Stickle, 2018, "DART mission update." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/stickle.pdf - M. Yoshikawa, 2018, "Current status of Hayabusa2." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/yoshikawa.pdf - Y. Fernandez, A. Virkki, 2018, "Arecibo under new management." See: https://ac.arc.nasa.gov/pr82k5ndie9g?proto=true - G. Bauer, M. Hilman, et al., 2018, "Merger between the Planetary Science Data System's Small Bodies Node and the Minor Planet Center." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/bauer.pdf - A. Mainzer, 2018, "NEOCam update." See: https://ac.arc.nasa.gov/pg1eh3yn8y0w?proto=true - T. Swindle, 2018, "SBAG and the Decadal Survey." See: https://ac.arc.nasa.gov/pn4ic69m5u8d?proto=true - H. Susorney, A. Rivkin, et al., 2018, "SBAG Goals document: science section update." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/susorney.pdf - P. Chodas, J. Dotson, T. Grav, et al., 2018, "SBAG Goal 2 – Planetary Defense." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/chodas.pdf - D. Adamo, 2018, "In-Space Resource Utilization related to SBAG Goal 3 (Enable Human Exploration)." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/14-

	adamo.pdf - A. Graps, 2018, "Goals – In-Situ Resource Utilization." See: https://ac.arc.nasa.gov/p2m3bj28i17i/?proto=true - C. Mercer, J. Castillo-Rogez, 2018, "Technology Goals for Small Bodies." See: https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/mercercer.pdf
2018, Jun 15	Apollo NEA 2018 LV3 ($H = 26.7$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.86 LD. Minimum miss distance 0.86 LD. [2018-37] See: 2018 LV3 - SSA , 2018 LV3 - JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/
2018, Jun 16	Apollo NEA 2018 MZ4 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.54 LD. Minimum miss distance 0.54 LD. [2018-38] See: 2018 MZ4 - SSA , 2018 MZ4 - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
2018, Jun 18	C. de la Fuente Marcos, R. de la Fuente Marcos, 2018, <i>Research Notes of the AAS</i>, 2, 57, "On the pre-impact orbital evolution of 2018 LA, parent body of the bright Fireball observed over Botswana on 2018 June 2." See: http://adsabs.harvard.edu/abs/2018RNAAS...2b..57D
2018, Jun 18	Apollo NEA 2018 MC7 ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 2.19 LD. Minimum miss distance 2.19 LD. See: 2018 MC7 - SSA , 2018 MC7 - JPL See also: https://cneos.jpl.nasa.gov/sentry/
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2018, Sep 1	J.A. Kwiecinski, A.L. Krause, R.A. Van Gorder, 2018, <i>Icarus</i> , 311, 170, "Effects of tidal torques on 1I/2017 U1 ('Oumuamua) ." See: http://adsabs.harvard.edu/abs/2018Icar..311..170K
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	See: http://adsabs.harvard.edu/abs/2018P%26SS..158...46O
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2018, Sep 3	Apollo NEA 2018 RR1 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.94 LD. Minimum miss distance 0.94 LD. [2018-44] See: 2018 RR1 - SSA , 2018 RR1 - JPL Discovery station: ... See: http://iawn.net/ See also: 4 Sep 2047 .
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2018, Sep 4	<i>ESA SSA-NEO Coordination Centre Newsletter</i>, 4 September 2018. See: http://neo.ssa.esa.int/newsletters
2018, Sep 4-6	<i>Asteroids and Comets - Inside Out Workshop (ACIO18)</i>, 4-6 September 2018, Tampere (Finland). See: http://www.tut.fi/en/asteroids-and-comets-inside-out-workshop Among the Keynote presentations: - B. Garcia Gutierrez, I. Carnelli, M. Küppers, 2018, "ESA's Hera mission to asteroid Didymos."
2018, Sep 5	Apollo NEA 2018 RS ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.27 LD. [2018-45] See: 2018 RS - SSA , 2018 RS - JPL Discovery station: ... See: http://iawn.net/
2018, Sep 6	Apollo NEA 2018 RE2 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2018-46] See: 2018 RE2 - SSA , 2018 RE2 - JPL Discovery station: ... See: http://iawn.net/
2018, Sep 7	Apollo NEA 2018 RJ3 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.43 LD. [2018-47] See: 2018 RJ3 - SSA , 2018 RJ3 - JPL See also: http://iawn.net/ Discovery station: ... See: http://iawn.net/
2018, Sep 8	Aten NEA 2018 RW ($H = 30.5$ mag, $D \approx 2.8$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [2018-48] See: 2018 RW - SSA , 2018 RW - JPL Discovery station: ... See: http://iawn.net/ See also: 21 Jun 1938.
2018, Sep 9	N.K. Inamdar, 2018, e-print <i>arXiv:1809.02915</i>, "The (non-

	)magnetization of 433 Eros: possible mechanisms for the lack of magnetism as measured by NEAR." See: http://adsabs.harvard.edu/abs/2018arXiv180902915I
2018, Sep 9	Aten NEA 2018 RC ($H = 25.0$ mag, $D \approx 40$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.58 LD. [2018-49] See: 2018 RC - SSA , 2018 RC - JPL Discovery station: ... See: http://iawn.net/
2018, Sep 10	Y. Shinnaka, T. Kasuga, R. Furusho, et al., 2018, <i>Astrophysical Journal Letters</i>, 864, L33, "Inversion angle of phase-polarization curve of near-Earth asteroid (3200) Phaethon." See: http://adsabs.harvard.edu/abs/2018ApJ...864L..33S
2018, Sep 10	T. Terai, H. Noda, N. Namiki, J.-i. Watanabe, 2018, <i>Astrophysical Journal Letters</i>, 864, L33, " Inversion angle of phase-polarization curve of Near-Earth Asteroid (3200) Phaethon." See: http://adsabs.harvard.edu/abs/2018ApJ...864L..33S
2018, Sep 12, 17:12	Apollo NEA 2018 RY5 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.47 LD. Minimum miss distance 0.47 LD. [2018-50] See: 2018 RY5 - SSA , 2018 RY5 - JPL Discovery station: ... See: http://iawn.net/
2018, Sep 12, 20:08	Apollo NEA 2018 RZ5 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.13 LD. [2018-51] See: 2018 RZ5 - SSA , 2018 RZ5 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2018, Sep 15	M. Granvik, A. Morbidelli, R. Jedicke, et al., 2018, <i>Icarus</i>, 312, 181, "Debiased orbit and absolute-magnitude distributions for Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2018Icar..312..181G
2018, Sep 15	M. Hamm, M. Grott, E. Kürt, et al., 2018, <i>Planetary and Space Science</i>, 159, 1, "A method to derive surface thermophysical properties of asteroid (162173) Ryugu (1999JU3) from in-situ surface brightness temperature measurements." See: http://adsabs.harvard.edu/abs/2018P%26SS..159....1H

2018, Sep 15	R. Jedicke, J. Sercel, J. Gillis-Davis, et al., 2018, <i>Planetary and Space Science</i> , 159, 28, "Availability and delta-v requirements for delivering water extracted from near-Earth objects to cis-lunar space." See: http://adsabs.harvard.edu/abs/2018P%26SS..159...28J
2018, Sep 15	Y. Yu, P. Michel, 2018, <i>Icarus</i> , 312, 128, "Ejecta cloud from the AIDA space project kinetic impact on the secondary of a binary asteroid: II. Fates and evolutionary dependencies." See: http://adsabs.harvard.edu/abs/2018Icar..312..128Y
2018, Sep 15	Apollo NEA 2018 SM ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.11 LD. Minimum miss distance 0.11 LD. [2018-52] See: 2018 SM - SSA , 2018 SM - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2018, Sep 16-21	European Planetary Science Congress (EPSC) , 16-21 September 2018, Berlin (Germany). See: http://www.epsc2018.eu/ Among the papers: - C. Burger, et al., 2018, "Hit-and-run heist of water by terrestrial planets in the early Solar System." See: http://www.europlanet-eu.org/hit-and-run-heist-of-water-by-terrestrial-planets-in-the-early-solar-system/
2018, Sep 18	B612 Newsletter, 18 September 2018. See: https://mailchi.mp/b612foundation/asteroids-beyond-the-b612-foundation-newsletter-vol-784597 See also: https://b612foundation.org/pew-poll-shows-public-believes-asteroid-monitoring-should-be-a-top-priority/
2018, Sep 18	Apollo NEA 2018 SC ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.70 LD. [2018-53] See: 2018 SC - SSA , 2018 SC - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/ See also: 15 Mrt 2016 .
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2018, Sep 21	M. Devogèle, A. Cellino, G. Borisov, et al., 2018, <i>Monthly Notices Royal Astronomical Society</i> , 479, 3498, "The phase-polarization curve of asteroid (3200) Phaethon ." See: http://adsabs.harvard.edu/doi/10.1093/mnras/sty1587
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2018, Sep 21	J.M. Hedo, M. Ruíz, J. Peláez, 2018, <i>Monthly Notices of the Royal Astronomical Society</i> , 479, 3288, "On the minimum orbital intersection distance computation: a new effective method." See: http://adsabs.harvard.edu/abs/2018MNRAS.479.3288H
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2018, Sep 24	T.D. Glotch, C.S. Edward, M. Yesiltas, et al., 2018, <i>Journal of Geophysical Research: Planets</i> , 123, 2467, "MGS-TES spectra suggest a basaltic component in the regolith of Phobos ." See: http://adsabs.harvard.edu/abs/2018JGRE..123.2467G See also: https://news.agu.org/press-release/martian-moon-may-have-come-from-impact-on-home-planet-new-study-suggests
2018, Sep 24	L. Maltagliati, 2018, <i>Nature Astronomy</i> , 2, 761, "Cometary Bennu ?" See: https://www.nature.com/articles/s41550-018-0599-5
2018, Sep 25	Aten NEA 2018 SD2 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.23 LD. [2018-54] See: 2018 SD2 - SSA , 2018 SD2 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2018, Sep 30	Apollo NEA 2018 TC ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.79 LD. Minimum miss distance 0.79 LD. [2018-55]

	See: 2018 TC - SSA , 2018 TC - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2018, Sep 30-Oct 3	<i>The First Billion Years: Bombardment</i> conference, 30 September - 3 October 2018, Flagstaff (AZ, USA). See: https://www.hou.usra.edu/meetings/bombardment2018/ Among the contributions: - W.F. Bottke, D. Nesvorny, F. Roig, et al., 2018, LPI Contribution No. 2107, id.2008, "Evidence for two impacting populations in the Early Bombardment of Mars and the Moon." See: http://adsabs.harvard.edu/abs/2018LPICo2107.2008B - S.F. Dermott, A.A. Christou, D. Li, 2018, LPI Contribution No. 2107, id.2012, "The common origin of family and non-family asteroids: the Late Heavy Bombardment." See: http://adsabs.harvard.edu/abs/2018LPICo2107.2012D - D.A. Kring, 2018, LPI Contribution No. 2107, id.2013, "Evaluating the relative contributions of asteroids and comets to the inner Solar System during the First Billion Years." See: http://adsabs.harvard.edu/abs/2018LPICo2107.2013K - D.A. Kring, 2018, "Testing bombardment models with human-assisted robotic missions and well-trained astronauts on the lunar surface." See: https://www.hou.usra.edu/meetings/bombardment2018/pdf/2023.pdf - A. Morbidelli, D. Nesvorny, V. Lau-renz, et al., 2018, "The timeline of the lunar bombardment - revisited." See: https://www.hou.usra.edu/meetings/bombardment2018/pdf/2005.pdf - T.D. Swindle, D.A. Kring, 2018, LPI Contribution No. 2107, id.2026, "Asteroidal constraints on the early bombardment history of the inner Solar System." See: http://adsabs.harvard.edu/abs/2018LPICo2107.2026S - N.E.B. Zellner, 2018, "The first billion years: impacts and life on Earth (and Mars?)." See: https://www.hou.usra.edu/meetings/bombardment2018/pdf/2016.pdf
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	Ryugu, targets of the OSIRIS-REx and Hayabusa2 missions." See: http://adsabs.harvard.edu/abs/2018Icar..313...25D
2018 Oct	L. Lan, X. Wang, H. Baoyin, J. Li, 2018, <i>Astrophysics and Space Science</i>, 363, 212, "Effect of temporary resonance with heterogeneous Itokawa." See: http://adsabs.harvard.edu/abs/2018Ap%26SS.363..212L
2018, Oct	J. Wu, S.J. Desch, L.Schaefer, et al., 2018, <i>Journal of Geophysical Research, Planets</i>, 123, 2691, "Origin of Earth's water: chondritic inheritance plus nebular ingassing and storage of hydrogen in the core." See: http://adsabs.harvard.edu/abs/2018JGRE..123.2691W See also: https://news.agu.org/press-release/scientists-theorize-new-origin-story-for-earths-water/
2018, Oct	T. Yamaguchi, T. Saiki, S. Tanaka, et al., 2018, <i>Acta Astronautica</i>, 151, 217, "Hayabusa2-Ryugu proximity operation planning and landing site selection." See: http://adsabs.harvard.edu/abs/2018AcAau.151..217Y
2018, Oct 1	A.P. Kartashova, O.P. Popova, D.O. Glazachev, P. Jenniskens, et al., 2018, <i>Planetary and Space Science</i>, 160, 107, "Study of injuries from the Chelyabinsk airburst event." See: http://adsabs.harvard.edu/abs/2018P%26SS..160..107K
2018, Oct 1	M. Losacco, P. Di Lizia, R. Armellin, A. Wittig, 2018, <i>Monthly Notices of the Royal Astronomical Society</i>, 479, 5474, "A differential algebra-based importance sampling method for impact probability computation on Earth resonant returns of Near Earth Objects." See: http://adsabs.harvard.edu/abs/2018MNRAS.479.5474L
2018, Oct 1-5	69th International Astronautical Congress, 1-5 October 2018, Bremen (Germany). See: http://www.iafastro.org/events/iac/iac-2018/ Late breaking news: Hayabusa2, Mascot, Minerva II , Friday 5 October, 08:30-09:30.
2018, Oct 3	ESA SSA-NEO Coordination Centre Newsletter, 3 October 2018. See: http://neo.ssa.esa.int/newsletters
2018, Oct 4	J.L. Hora, A. Siraj, M. Mommert, et al., 2018, <i>Astrophysical Journal Supplement Series</i>, 238, 22, "Infrared light curves of Near-Earth Objects." See: http://adsabs.harvard.edu/abs/2018ApJS..238...22H

2018, Oct 6	Apollo NEA 2018 TV5 ($H = 29.5$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.27 LD. [2018-56] See: 2018 TV5 - SSA , 2018 TV5 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2018, Oct 7	Apollo NEA 2018 TV ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.74 LD. Minimum miss distance 0.74 LD. [2018-57] See: 2018 TV - SSA , 2018 TV - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2018, Oct 12	M. Lingam, A. Loeb, 2018, <i>Astronomical Journal</i>, 156, 193, "Implications of captured interstellar objects for panspermia and extraterrestrial life." See: http://adsabs.harvard.edu/abs/2018AJ....156..193L See also: https://www.scientificamerican.com/article/will-astronomers-be-ready-for-the-next-iso-oumuamua/ http://astrobiology.com/2018/01/implications-of-captured-interstellar-objects-for-panspermia-and-extraterrestrial-life.html
2018, Oct 13	E. Asphaug, 2018, in: L.T. Elkins-Tanton & B. P. Weiss (eds.), chapter <i>for Planetesimals: Early Differentiation and Consequences for Planets</i> (Cambridge University Press, 2017), e-print <i>arXiv:1810.05797</i>, "Signatures of hit and run collisions." See: http://adsabs.harvard.edu/abs/2018arXiv181005797A https://www.cambridge.org/core/books/planetesimals/signatures-of-hitandrun-collisions/

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2018, Oct 15	Y. Jiang, H. Baoyin, 2018, <i>Planetary and Space Science</i> , 161, 107, "Annihilation of relative equilibria in the gravitational field of irregular-shaped minor celestial bodies." See: http://adsabs.harvard.edu/abs/2018P%26SS..161..107Y
2018, Oct 15	T. Kohout, A. Näsilä, T. Tikka, et al., 2018, <i>Advances in Space Research</i> , 62, 2239, "Feasibility of asteroid exploration using CubeSats-ASPECT case study." See: http://adsabs.harvard.edu/abs/2018AdSpR..62.2239K
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2018, Oct 15	R. Lasagni Manghi, D. Modenini, M. Zannoni, P. Tortora, 2018, <i>Advances in Space Research</i> , 62, 2290, "Preliminary orbital analysis for a CubeSat mission to the Didymos binary asteroid system." See: http://adsabs.harvard.edu/abs/2018AdSpR..62.2290L
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2018, Oct 15	E. Palomba (Guest Editor), M.A. Shea, 2018, <i>Advances in Space Research</i> , 62, 1919, "Preface: <i>Past, present and future of small body science and exploration</i> ." See: http://adsabs.harvard.edu/abs/2018AdSpR..62.1919P

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2018, Oct 15	M. Sokolova, M. Sergienko, Y. Nefedyev, et al., 2018, <i>Advances in Space Research</i> , 62, 2355, "Genetic analysis of parameters of Near Earth Asteroids for determining parent bodies of meteoroid streams." See: http://adsabs.harvard.edu/abs/2018AdSpR..62.2355S
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2018, Oct 17	Apollo NEA 2018 UL ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.57 LD. [2018-58] See: 2018 UL - SSA , 2018 UL - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
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2018, Oct 21-26	6th International Asteroid Warning Network (IAWN) Steering Committee Meeting, in the marges of the DPS Meeting, Knoxville (TN, USA). See: http://iawn.net/meetings/5th-steering-cmte.shtml
2018, Oct 22	A. Moro-Martín, 2018, <i>Astrophysical Journal</i>, 866, 131, "Origin of 1I/'Oumuamua. I. An ejected protoplanetary disk object?" See: http://adsabs.harvard.edu/abs/2018ApJ...866..131M
2018, Oct 26	Apollo NEA 2020 CD3 ($H = 31.7$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2018-60] See: 2020 CD3 – S2P , 2020 CD3 – JPL See also: 18 Sep 2017, 6 Dec 2017, 19 Feb 2018, 9 May 2018, 9 Aug 2018, 16 Jan 2019, 4 Apr 2019, 30 Jun 2019, 10 Sep 2019, 18 Nov 2019, 13 Feb 2020.
2018, Oct 29	Apollo NEA 475534 (2006 TS7), $H = 21.3$ mag, $D \approx 200$ m, PHA) passed Earth at a nominal miss distance of 7.51 LD. Minimum miss distance 7.51 LD. See: 2006 TS7 - SSA , 2006 TS7- JPL See also: 1 Nov 2200.
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2018, Oct 31	R.R. Rafikov, 2018, <i>Astrophysical Journal Letters</i>, 867, L17, "Spin evolution and cometary interpretation of the interstellar minor object 1I/2017 'Oumuamua." See: http://adsabs.harvard.edu/abs/2018ApJ...867L..17R
2018, Nov	M.C.F. Bazzocchi, M.R. Emami, 2018, <i>Acta Astronautica</i>, 152, 705, "Stochastic optimization of asteroid three-dimensional trajectory transfer." See: http://adsabs.harvard.edu/abs/2018AcAau.152..705B

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2018, Nov	M.-J. Kim, H.-J. Lee, S.-M. Lee, et al., 2018, <i>Astronomy & Astrophysics</i> , 619, 123, "Optical observations of NEA 3200 Phaethon (1983 TB) during the 2017 apparition." See: http://adsabs.harvard.edu/abs/2018A%26A...619A.123K
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2018, Nov	Y. Qi, A. de Ruiter, 2018, <i>Acta Astronautica</i> , 152, 836, "Low-energy transfers to long-term capture in the Earth-Moon system." See: http://adsabs.harvard.edu/abs/2018AcAau.152..836Q
2018, Nov	Y. Shi, Y. Wang, S. Xu, 2018, <i>Acta Astronautica</i> , 152, 208, "Relative equilibria and stability of a dumbbell spacecraft about an asteroid." See: http://adsabs.harvard.edu/abs/2018AcAau.152..208S
2018, Nov	M. Tan, C. McInnes, M. Ceriotti, 2018, <i>Acta Astronautica</i> , 152, 185, "Capture of small near-Earth asteroids to Earth orbit using aerobraking." See: http://adsabs.harvard.edu/abs/2018AcAau.152..185T
2018, Nov	E.M. Xilouris, A.Z. Bonanos, I. Bellas-Velidis, et al., 2018, <i>Astronomy & Astrophysics</i> , 619, 141 " NELIOTA : the wide-field, high-cadence lunar monitoring system at the prime focus of the Kryoneri telescope." See: http://adsabs.harvard.edu/abs/2018A%26A...619A.141X
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2018, Nov 4-7	<i>The Geological Society of America 130th Annual Meeting</i> , 4-7 November 2018, Indianapolis (IN, USA). See: https://community.geosociety.org/gsa2018/home
2018, Nov 5	ESA SSA-NEO Coordination Centre Newsletter, 5 November 2018. See: http://neo.ssa.esa.int/newsletters
2018, Nov 5	A. Thirouin, N.A. Moskovitz, R.P. Binzel, et al., 2018, <i>Astrophysical Journal Supplement Series</i> , 239, 4, "The Mission Accessible Near-Earth Objects Survey : four years of photometry." See: http://adsabs.harvard.edu/abs/2018ApJS..239....4T
2018, Nov 5	J.L. Tonry, L. Denneau, H. Flewelling, et al., 2018, <i>Astrophysical</i>

	<i>Journal</i>, 867, 105, "The ATLAS all-sky stellar reference catalog." See: http://adsabs.harvard.edu/abs/2018ApJ...867..105T
2018, Nov 5 01:32	Apollo NEA 2018 VT5 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.48 LD. Minimum miss distance 0.48 LD. [2018-62] See: 2018 VT5 - SSA , 2018 VT5 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Nov 5 18:00	Apollo NEA 2018 TF3 ($H = 20.5$ mag, $D \approx 280$ m, PHA) passed Earth at a nominal miss distance of 7.77 LD. Minimum miss distance 7.77 LD. See: 2015 TF3 - SSA , 2015 TF3 - JPL
2018, Nov 5	ESA NEOCC <i>Newsletter</i>: November 2018. See: http://neo.ssa.esa.int/
2018, Nov 6	Apollo NEA 2018 VO5 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.37 LD. Minimum miss distance 0.37 LD. [2018-63] See: 2018 VO5 - SSA , 2018 VO5 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Nov 7	S. Kohler, 2018, <i>AAS Nova Highlight</i>, 7 November 2018, id.4232, "Revisiting interstellar asteroid 'Oumuamua." See: http://adsabs.harvard.edu/abs/2018nova.pres.4232K
2018, Nov 9	E. Landau, 2018, NASA, "Cosmic detective work: why we care about space rocks." See: https://www.nasa.gov/feature/jpl/cosmic-detective-work-why-we-care-about-space-rocks See also: https://earthsky.org/space/reasons-to-study-asteroids
2018, Nov 10	Apollo NEA 2018 VX1 = 2018 VA6 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2018-64] See: 2018 VX1 - SSA , 2018 VX1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 11 Nov 1959.
2018, Nov 11	F. Almeida-Fernandes, H.J. Rocha-Pinto, 2018, <i>Monthly Notices of the Royal Astronomical Society</i>, 480, 4903, "A kinematical age for the interstellar object 1I/'Oumuamua."

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2018, Nov 11	Apollo NEA 2015 TB145 ($H = 20.2$ mag, $D \approx 600$ m, PHA, possibly a dead comet) passed Earth at a nominal miss distance of 103.97 LD. Minimum miss distance 103.94 LD. See: 2015 TB145 - SSA , 2015 TB145 - JPL Ref: - T.G. Müller, A. Marciniak, M. Butkiewicz-Bąk, et al., 2017, <i>Astronomy & Astrophysics</i>, 598, 63, "Large Halloween asteroid at lunar distance." See: http://adsabs.harvard.edu/abs/2017A%26A...598A..63M See also: http://neo.jpl.nasa.gov/news/news190.html http://gawker.com/asteroid-to-strike-earth-on-halloween-scaremongering-1737772849 http://www.jpl.nasa.gov/news/news.php?feature=4760 http://www.jpl.nasa.gov/news/news.php?feature=4763 https://www.space.com/39173-halloween-asteroid-2015-tb145-returns-2018.html https://en.wikipedia.org/wiki/2015_TB145 See also: 31 Oct 2015.
2018, Nov 12	M. Bartels, 2018, <i>Space.com</i>, 42389, 12 November 2018, "Astronaut Rusty Schweickart looks back on Apollo 9, and to the next asteroid impact." See: https://www.space.com/42389-apollo-astronaut-rusty-schweickart-asteroid-planetary-protection.html
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2018, Nov 13 02:24	Aten NEA 2018 VC7 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.87 LD. Minimum miss distance 0.87 LD. [2018-65] See: 2018 VC7 - SSA , 2018 VC7 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2018, Nov 13 18:28	Aten NEA 2018 WA1 ($H = 30.1$ mag, $D \approx$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2018-66]

	See: 2018 WA1- SSA , 2018 WA1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Nov 14	C. Cofield, 2018, <i>NASA JPL News</i>, 14 November 2018, "NASA learns more about interstellar visitor 'Oumuamua." See: https://www.jpl.nasa.gov/news/news.php?release=2018-262
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2018, Nov 14	Apollo NEA 2018 VJ10 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.51 LD. [2018-67] See: 2018 VJ10 - SSA , 2018 VJ10 - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/ See also: 15 Nov 1946.
2018, Nov 15	L.F. Wheeler, D.L. Mathias, E. Stokan, P.G. Brown, 2018, <i>Icarus</i>,

	315, 79, "Atmospheric energy deposition modeling and inference for varied meteoroid structures." See: http://adsabs.harvard.edu/abs/2018Icar..315...79W
2018, Nov 15-16	Hera Community Workshop , 15-16 November 2018, Berlin (Germany). See: https://www.cosmos.esa.int/web/hera-community-workshop/
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2018, Nov 16 05:49	Apollo NEA 2018 WH ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.50 LD. [2018-68] See: 2018 WH - SSA , 2018 WH - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 16 Nov 2022 .
2018, Nov 16 19:14	Apollo NEA 2018 WG ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.080 LD (= 4.84 R_{Earth} from the geocenter). Minimum miss distance 0.080 LD. [2018-69] See: 2018 WG - SSA , 2018 WG - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 16 Nov 2023 .
2018, Nov 18	Apollo NEA 2018 WE ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2018-70] See: 2018 WE - SSA , 2018 WE - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Nov 18	K. Haynes, 2018, <i>Astronomy</i> , 19 November 2018, "How would we save the planet from a killer asteroid?" See: http://www.astronomy.com/news/2018/11/how-would-we-save-the-

	planet-from-a-killer-asteroid
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2018, Nov 25	S. Siegert, L.Hecht, 2018, <i>Meteoritics & Planetary Science</i>, Early View, "Heterogeneity of melts in impact deposits and implications for their origin (Ries suevite, Germany)." See: https://onlinelibrary.wiley.com/doi/10.1111/maps.13210
2018, Nov 25	Apollo NEA 2018 WE1 ($H = 26.2$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2018-72] See: 2018 WE1 - SSA , 2018 WE1 - JPL Discovery station: ATLAS-MLO, Mauna Loa

	See: http://iawn.net/ See also: 25 Nov 1959.
2018, Nov 27	Apollo NEA 2018 WZ1 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2018-73] See: 2018 WZ1 - SSA , 2018 WZ1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Nov 28	Apollo NEA 2018 WA3 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2018-74] See: 2018 WA3 - SSA , 2018 WA3 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2018, Nov 29	T. Kareta, V. Reddy, C. Hergenrother, et al., 2018, <i>Astronomical Journal</i> , 156, 287, "Rotationally resolved spectroscopic characterization of Near-Earth Object (3200) Phaethon ." See: http://adsabs.harvard.edu/abs/2018AJ....156..287K
2018, Nov 29	A. Witze, 2019, <i>Nature News</i> , 29 Nov 2018, "Asteroid-sampling mission zeroes in on tiny space rock." See: https://www.nature.com/articles/d41586-018-07563-y
2018, Nov 29	Andrea Milani (1948-2018) passed away in Pisa (Italy), 28 November 2018. He has been a passionate advocate of the Planetary Defence discipline in the last 20 years, in order to ensure that our society is prepared to face the threat posed by the near-Earth asteroids. See: http://neo.ssa.esa.int/news-archive http://www.esa.int/Our_Activities/Space_Engineering_Technology/Hera/Andrea_Milani_1948_2018
2018, Nov 30	Apollo NEA 2018 WG2 ($H = 30.2$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.52 LD. [2018-75] See: 2018 WG2 - SSA , 2018 WG2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 28 Nov 1982.
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2018, Dec	D. Morrison, 2018, <i>Tunguska Workshop: applying modern tools to understand the 1908 Tunguska impact</i> . NASA/Technical Memorandum (NASA/TM--220174) 2018. See: https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20190002302.pdf See also: https://www.lpi.usra.edu/sbag/meetings/jan2018/presentations/1150-Morrison.pdf See also: 15 July 2019 .
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2018, Dec 2	Apollo NEA 2018 WV1 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.086 LD ($= 5.19 R_{\text{Earth}}$ from the geocenter). Minimum miss distance 0.086 LD. [2018-76] See: 2018 WV1 - SSA , 2018 WV1 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: https://cneos.jpl.nasa.gov/news/news202.html https://en.wikipedia.org/wiki/2018_WV1
2018, Dec 3	Arrival of NASA spacecraft <i>Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer (OSIRIS-REx)</i>, an asteroid sample return mission, at target asteroid 101955 (1999 RQ36 = Bennu, $H = 20.8$ mag, $D \approx 525$ m, NEO, PHA). The 2,110-kg spacecraft was launched on 8 September 2016. After a careful survey of Bennu to characterize the asteroid and locate the most promising sample sites, OSIRIS-REx will collect between 60 to 2,000 grams of surface material with its robotic arm, depart from Bennu in May 2021, and return the sample to Earth via a detachable capsule on 24 September 2023. See: http://www.nasa.gov/osiris-rex http://science.nasa.gov/missions/osiris-rex/ https://www.nasa.gov/sites/default/files/atoms/files/osiris_rex_factsheet5-9.pdf http://www.asteroidmission.org/ https://osirisrex.arizona.edu/content/information-media http://www.space.com/11802-nasa-asteroid-mission-dangerous-1999-rq36.html http://www.space.com/11808-nasa-asteroid-mission-osiris-rex-1999-rq36-infographic.html http://www.space.com/12065-osiris-rex-asteroid-generations.html http://web.mit.edu/newsoffice/2011/asteroid-mission-0726.html http://www.space.com/13132-potentially-killer-asteroids-earth-nasa.html http://www.nasa.gov/press/2014/april/construction-to-begin-on-nasa-spacecraft-set-to-visit-asteroid-in-2018/ http://adsabs.harvard.edu/abs/2016Sci...353..974V https://ww2.kqed.org/science/2017/09/29/why-is-nasa-checking-out-this-asteroid/ https://www.nasa.gov/image-feature/from-the-earth-moon-and-beyond https://www.space.com/39701-earth-moon-40-million-miles-nasa-photo.html https://www.space.com/20920-nasa-osiris-rex-asteroid-mission-photos.html https://www.space.com/39958-asteroid-bennu.html https://cneos.jpl.nasa.gov/news/news201.html https://www.space.com/41544-nasa-osiris-rex-asteroid-bennu-final-approach.html https://uanews.arizona.edu/story/osirisrex-captures-first-glimpse-asteroid-

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2018, Dec 4-7	<i>Hayabusa 2018 : 6th Symposium of Solar System Materials</i>, 4-7 December 2018, Sagami-hara City (Kanagawa, Japan). See: https://curation.isas.jaxa.jp/symposium/index.html
2018, Dec 5	ESA NEOCC Newsletter: December 2018. See: http://neo.ssa.esa.int/newsletters
2018, Dec 6	Anon., 2018, ESA SSA, "Learning from lunar lights." See: http://www.esa.int/Our_Activities/Operations/Space_Situational_Awareness/Learning_from_lunar_lights
2018, Dec 8	Apollo NEA 2018 XP2 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 1.009 LD. Minimum miss distance 1.003 LD. See: 2018 XP2 - SSA , 2018 XP2 - JPL
2018, Dec 10-14	<i>American Geophysical Union Fall Meeting</i>, 10-14 December 2018, Washington (DC, USA). See: https://fallmeeting.agu.org/2018/ Among the abstracts:

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2018, Dec 22	Aten NEA 163899 (2003 SD220 , $H = 17.9$ mag, $D \approx 1000$ m, PHA) passed Earth at a nominal miss distance of 7.36 LD. Minimum miss distance 7.36 LD. See: 163899 2003 SD220 - SSA , 2003 SD220 - JPL See also: https://www.jpl.nasa.gov/news/news.php?feature=7312 https://phys.org/news/2018-12-mile-wide-potentially-hazardous-asteroid-sd220.html https://en.wikipedia.org/wiki/(163899)_2003_SD220
2018, Dec 24	W.U. Reimold, A. Penteado Crósta, M. Hasch, et al., 2018, <i>Meteoritics & Planetary Science</i> , Early View, "Shock deformation confirms the impact origin for the Cerro do Jarau, Rio Grande do Sul, Brazil, structure." See: https://onlinelibrary.wiley.com/doi/10.1111/maps.13233
2018, Dec 27	M. Brozović, L.A.M. Benner, J.D. Giorgini, et al., 2018, <i>Astronomical Journal</i> , 157, 24, " Goldstone radar observations of horseshoe-orbiting Near-Earth Asteroid 2013 BS45 , a potential mission target." See: http://adsabs.harvard.edu/abs/2019AJ....157...24B
2018, Dec 27	Apollo NEA 2018 YL2 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.15 LD. Minimum miss distance 0.15 LD. [2018-78] See: 2018 YL2 - SSA , 2018 YL2 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2018, Dec 28 06:27	Apollo NEA 2018 YO2 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.51 LD. Minimum miss distance 0.51 LD. [2018-79] See: 2018 YO2 - SSA , 2018 YO2 - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/ See also: 11 Jan 1906 .
2018, Dec 28 12:36	Apollo NEA 2019 AW2 ($H = 25.4$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2018-80]

	See: 2019 AW2 - SSA , 2019 AW2 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2018, Dec 31	J. Thangavelautham, E. Asphaug, S. Schwartz, 2018, in: <i>IEEE Aerospace Conference 2019</i> , e-print <i>arXiv:1812.11663</i> , "An on-orbit CubeSat centrifuge for asteroid science and exploration." See: http://adsabs.harvard.edu/abs/2018arXiv181211663T https://ieeexplore.ieee.org/document/8741839
2019, Jan 1	19285 NEAs known (ranging in size up to ~37 km: 1036 Ganymed , A924 UB , $H = 9.45$ mag, $D = 36.5$ km, Amor NEA), of which 1957 PHAs (ranging in size from 140 m up to ~5 km: 4179 Toutatis , 1989 AC , $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, Apollo NEA, PHA). See: https://cneos.jpl.nasa.gov/stats/totals.html
2019, Jan	D. Appell, 2019, <i>Physics World</i> , 32, 45, "Hellions of the solar system." See: http://adsabs.harvard.edu/abs/2019PhyW...32a..45A
2019, Jan	G. Benedetti, N. Bloise, D. Boi, et al., 2019, <i>Acta Astronautica</i> , 154, 238, "Interplanetary CubeSats for asteroid exploration: mission analysis and design." See: http://adsabs.harvard.edu/abs/2019AcAau.154..238B
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2019, Jan	Q.H.S. Chan, A. Nakato, Y. Kebukawa, et al., 2019, <i>Meteoritics & Planetary Science</i> , 54, 104, "Heating experiments of the Tagish Lake meteorite : investigation of the effects of short-term heating on chondritic organics." See: http://adsabs.harvard.edu/abs/2019M%26PS...54..104C
2019, Jan	C. de la Fuente Marcos, R. de la Fuente Marcos, 2019, <i>Astronomy & Astrophysics</i> , 621, 137, "Waiting to make an impact: a probable excess of near-Earth asteroids in 2018 LA -like orbits." See: http://adsabs.harvard.edu/abs/2019A%26A...621A.137D
2019, Jan	B. Dermawan, 2019, <i>Journal of Physics: Conference Series</i> , 1127, 012038, "Temporal Earth coorbital types of asteroid 2016 HO3 ." See: http://adsabs.harvard.edu/abs/2019JPhCS1127a2038D
2019, Jan	M.A. Galiazzo, E. A. Silber, R. Dvorak, 2019, <i>Monthly Notices of the</i>

	Royal Astronomical Society, 482, 771, "The threat of Centaurs for terrestrial planets and their orbital evolution as impactors." See: http://adsabs.harvard.edu/abs/2019MNRAS.482..771G See also: https://medienportal.univie.ac.at/presse/aktuelle-pressemeldungen/detailansicht/artikel/wenn-centauren-die-erde-bedrohen/
2019, Jan	C.D. Grimm, J.-T. Grundmann, J. Hendrikse, et al., 2019, <i>Progress in Aerospace Sciences</i>, 104, 20, "From idea to flight - a review of the Mobile Asteroid Surface Scout (MASCOT) development and a comparison to historical fast-paced space programs." See: http://adsabs.harvard.edu/abs/2019PrAeS.104...20G
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2019, Jan	M. Yusuf, P. Mahasena, A.T.P. Jatmiko, et al., 2019, <i>Journal of Physics: Conference Series</i> , 1127, 012045, " Bosscha Robotic Telescope (BRT) - a 0.35 meter telescope on Bosscha Observatory." See: http://adsabs.harvard.edu/abs/2019JPhCS1127a2045Y
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2019, Jan 8	Apollo NEA 2019 AS5 ($H = 32.3$ mag, $D \approx 1.2$ m) passed Earth at a nominal miss distance of 0.039 LD (= 2.37 R_{Earth} from the geocenter). Minimum miss distance 0.039 LD. [2019-01] It passed the Moon at a nominal miss distance of 0.415 LD. Minimum miss distance 0.414 LD. See: 2019 AS5 - SSA , 2019 AS5 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: http://neo.ssa.esa.int/newsletters [June 2020] https://en.wikipedia.org/wiki/2019_AS5

	See also: 9 Jan 2055.
2019, Jan 12	Apollo NEA 2019 AE9 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.26 LD. Minimum miss distance 0.26 LD. [2019-02] See: 2019 AE9 - SSA , 2019 AE9 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2019, Jan 13	M.A. Cox, A.J. Cavosie, L. Ferrière, et al., 2019, <i>Meteoritics & Planetary Science</i> , 54, 621, "Shocked quartz in polymict impact breccia from the Upper Cretaceous Yallalie impact structure in Western Australia." See: http://adsabs.harvard.edu/abs/2019M%26PS...54..621C See also: https://news.curtin.edu.au/media-releases/curtin-university-crater-hunters-score-meteoric-hole-in-one/
2019, Jan 14	V. Bacu, A. Sabou, T. Stefanut, et al., 2019, submitted to IEEE 14th International Conference on Intelligent Computer Communication and Processing (ICCP) , Cluj-Napoca (Romania), e-print <i>arXiv:1901.04248</i> , " NEARBY platform for detecting asteroids in astronomical images using cloud-based containerized applications." See: https://arxiv.org/abs/1901.04248
2019, Jan 16, 01:13	Apollo NEA 2019 BO ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.18 LD. Minimum miss distance 0.18 LD. [2019-03] See: 2019 BO - SSA , 2019 BO - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2019, Jan 16, 17:12	Apollo NEA 2020 CD3 ($H = 31.8$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2019-04] See: 2020 CD3 - S2P , 2020 CD3 – JPL Discovery station: calculated See also: 18 Sep 2017, 6 Dec 2017, 19 Feb 2018, 9 May 2018, 9 Aug 2018, 26 Oct 2018, 4 Apr 2019, 30 Jun 2019, 10 Sep 2019, 18 Nov 2019, 13 Feb 2020. See also: https://www.theatlantic.com/science/archive/2020/02/mini-moon-earth/607171/ https://www.theatlantic.com/science/archive/2020/03/mini-moon-earth-lost/608455/
2019, Jan 18	C. Koeberl, 2019, <i>Science</i> , 363, 224, "When Earth got pummeled."

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2019, Jan 18	S. Mazrouei, R.R. Ghent, W.F. Bottke, et al., 2019, <i>Science</i> , 363, 253, " Earth and Moon impact flux increased at the end of the Paleozoic." See: http://adsabs.harvard.edu/abs/2019Sci...363..253M See also: https://www.swri.org/press-release/swri-moon-craters-compare-earth-impact-history-lro https://www.livescience.com/64531-huge-asteroid-impacts-are-common.html http://science.sciencemag.org/content/363/6424/224
2019, Jan 18	A. Siraj, A. Loeb, 2019, <i>Research Notes of the American Astronomical Society</i> , 3, 15, " Oumuamua 's geometry could be more extreme than previously inferred." See: http://adsabs.harvard.edu/abs/2019RNAAS...3a..15S
2019, Jan 21	F. Valdes, 2019, e-print <i>arXiv</i> :1901.07111, "A new method for estimating the absolute magnitude frequency distribution of Near Earth Asteroids (NEAs)." See: http://adsabs.harvard.edu/abs/2019arXiv190107111V
2019, Jan 22	M. Bartels, 2019, <i>Space.com</i> , 22 January 2019, "Watch a meteor smack the Blood Moon in this lunar eclipse video!." See: https://www.space.com/43075-blood-moon-2019-meteor-impact-video.html See also: https://www.syfy.com/syfywire/an-asteroid-impacted-the-moon-during-the-lunar-eclipse http://spaceweather.com/archive.php?view=1&day=23&month=01&year=2019
2019, Jan 23	D.S. Grewal, R. Dasgupta, C. Sun, et al., 2019, <i>Science Advances</i> , 5, eaau3669, "Delivery of carbon, nitrogen, and sulfur to the silicate Earth by a giant impact." See: http://advances.sciencemag.org/content/5/1/eaau3669 See also: http://news.rice.edu/2019/01/23/planetary-collision-that-formed-the-moon-made-life-possible-on-earth-2/ https://www.space.com/43103-planetary-collision-life-earth.html https://www.space.com/43110-moon-forming-impact-life-on-earth.html
2019, Jan 22-24	ESA NEO and Debris Detection Conference -- Exploiting Synergies , 22-24 January 2019, ESA/ESOC, Darmstadt (BRD). See: https://neo-sst-conference.sdo.esoc.esa.int/ http://neo.ssa.esa.int/news-archive

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	[2019-05] See: 2019 BV1 - SSA , 2019 BV1 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2019, Jan 25	V. Gajjar, N. Gizani, G. Hellbourg, H. Isaacson, 2019, <i>Research Notes of the American Astronomical Society</i>, 3, 19, "Breakthrough Listen observations of asteroid (514107) 2015 BZ509 with the Parkes Radio Telescope." See: http://adsabs.harvard.edu/abs/2019RNAAS...3a..19P
2019, Jan 27	Apollo NEA 2019 BZ3 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.13 LD. [2019-06] See: 2019 BZ3 - SSA , 2019 BZ3 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Jan 28	C. Chen, J.L. Smallwood, R.G. Martin, M. Livio, 2019, <i>Astronomical Journal</i>, 157, 80, "Late delivery of nitrogen to Earth." See: http://adsabs.harvard.edu/abs/2019AJ....157...80C
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	https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Tuesday-PM/Tsuda.pdf - D.S. Lauretta, NASA-GSFC, 2019, "OSIRIS-REx update." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Wednesday-AM/Lauretta.pdf - K. Righter, NASA-JSC, 2019, "Asteroid-meteorite connections: new asteroid curation facilities and US Antarctic meteorite collection at JSC." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Wednesday-AM/Righter.pdf - R. Binzel, MIT, 2019, "Apophis 2029, a once-per-thousand year opportunity for science and Planetary Defense." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Wednesday-AM/Binzel.pdf - A. Mainzer, NASA-JPL, 2019, "NEOCam update." - Anon., 2019, "SBAG and the Decadal Survey" - E. Adams, 2019, "DART update." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Wednesday-PM/Adams.pdf - J. Masiero, A.K. Mainzer, J.M. Bauer, et al., NASA-JPL, 2019, "Update on the NEOWISE project." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Wednesday-PM/Masiero.pdf - T. Swindle, 2019, "SBAG goals." - C. Ernst, 2019, "Goals – Diversity and workforce." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Thursday-AM/Ernst.pdf - D. Britt, UCF, 2019, "SBAG Resource Utilization (RU) Goals document." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Thursday-AM/Britt.pdf - A. Rivkin, JHU/APL, 2019, "SBAG Goals document Science Section discussion." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Thursday-AM/Rivkin.pdf - P. Chodas, NASA-JPL/Caltech, J. Dotson, ARC, T. Grav, PSI, et al., 2019, "SBAG Goal 2: defend Planet Earth." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Thursday-AM/Chodas.pdf - D.R. Adamo, LPI, 2019, "In-Space Resource Utilization (ISRU) related to SBAG Goal 3 (Enable Human Exploration)." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Thursday-AM/Adamo.pdf - C. Mercer, J. Castillo-Rogez, E. Adams, 2019, "Technology goals for small bodies." See: https://www.lpi.usra.edu/sbag/meetings/jan2019/presentations/Thursday-AM/Mercer.pdf
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	debris of dwarf interstellar comet that disintegrated before perihelion." See: https://arxiv.org/abs/1901.08704 See also: https://www.space.com/43229-oumuamua-monstrous-fluffy-comet-dust.html
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2019, Feb 26, 07:39	Apollo NEA 2019 DG2 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.61 LD. Minimum miss distance 0.61 LD. [2019-08] See: 2019 DG2 - SSA , 2019 DG2 - JPL Discovery station: ... See: http://iawn.net/
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2019, May 3	ESA NEOCC Newsletter: May 2019. See: http://neo.ssa.esa.int/newsletters
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2019, Jun 19	ESA's new mission to intercept a comet: 'Comet Interceptor', has been selected as ESA's new fast-class mission in its Cosmic Vision Programme. Comprising three spacecraft, it will be the first to visit a truly pristine comet or other interstellar object that is only just starting its journey into the inner Solar System. Foreseen launch to in 2028, to Sun-Earth Lagrange point L2 at 1.5 million kilometres 'behind' Earth as viewed from the Sun. See: http://www.esa.int/Our_Activities/Space_Science/ESA_s_new_mission_to_intercept_a_comet
2019, Jun 20	G. Hautaluoma, A. Johnson, D.C. Agle, 2019, <i>NASA JPL News</i>, 20 June 2019, "Small Satellite Concept finalists target Moon, Mars and beyond," including Janus: Reconnaissance Missions to Binary Asteroids that will study the formation and evolutionary implications for small "rubble pile" asteroids and build an accurate model of two binary asteroid bodies. PI: Daniel Scheeres, University of Colorado. See: https://www.jpl.nasa.gov/news/news.php?feature=7431
2019, Jun 22, 21:26	Impact. Apollo NEA 2019 MO ($H = 29.3$ mag, $D \approx 6$ m) impacted the Earth atmosphere over the Caribbean Sea on 22 June 2019, and exploded at an altitude of ~ 25 km over the sea surface, releasing an energy of 6 kT of TNT. See: 2019 MO - JPL , 2019 MO - SSA See also: 27 Jun 1987. Object impacted Earth on 22 June 2019, 21:25:48 Discovery station: ATLAS-MLO, Mauna Loa See also: http://iawn.net/ See also: https://www.jpl.nasa.gov/news/news.php?feature=7438

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2019, Jul 25	Apollo NEA 2019 OK ($H = 23.1$ mag, $D \approx 80$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2019-35] Largest asteroid to pass this close to Earth in a century See: 2019 OK - SSA , 2019 OK - JPL Discovery station: SONEAR Observatory, Oliveira See: http://iawn.net/ See also: http://www.sci-news.com/astronomy/asteroid-2019-ok-07446.html http://neo.ssa.esa.int/newsletters [August] https://cneos.jpl.nasa.gov/news/news203.html https://en.wikipedia.org/wiki/2019_OK
2019, Jul 26	Aten NEA 2010 PK9 ($H = 22.0$ mag, $D \approx 143$ m, PHA) passed Earth at a nominal miss distance of 8.20 LD. Minimum miss distance 8.20 LD. See: 2010 PK9 - SSA , 2010 PK9 - JPL
2019, Jul 28	Apollo NEA 2019 OD3 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2019-36] See: 2019 OD3 - SSA , 2019 OD3 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2019, Jul 29	Apollo NEA 2019 ON3 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.56 LD. Minimum miss distance 0.55 LD. [2019-37] See: 2019 ON3 - SSA , 2019 ON3 - JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/
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	distance 19.37 LD. See: 2006 QQ23 - SSA , 2006 QQ23 - JPL See also: https://www.space.com/large-asteroid-2006-QQ23-earth-flyby.html https://en.wikipedia.org/wiki/2006_QQ23
2019, Aug 16	Apollo NEA 2019 PJ ($H = 24.1$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 8.74 LD. Minimum miss distance 8.68 LD. See: 2019 PJ - SSA , 2019 PJ – JPL
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2019, Aug 20, 11:5	Apollo NEA 2019 QB1 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.32 LD. Minimum miss distance 0.32 LD. [2019-38] See: 2019 QB1 - SSA , 2019 QB1 – JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/
2019, Aug 20 18:12	Apollo NEA 2019 QH2 ($H = 30.4$ mag, $D \approx 2.9$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.13 LD. [2019-39] See: 2019 QH2 – SSA , 2019 QH2 - JPL Discovery station: ... See: http://iawn.net/
2019, Aug 22	Apollo NEA 2019 QD ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.78 LD. Minimum miss distance 0.78 LD. [2019-40] See: 2019 QD - SSA , 2019 QD – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2019, Aug 26 08:51	Apollo NEA 2019 QR8 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.77 LD. [2019-41] See: 2019 QR8 – SSA , 2019 QR8 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2019, Aug 26 15:14	Apollo NEA 2019 QQ3 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.25 LD. [2019-42] See: 2019 QQ3 – SSA , 2019 QQ3 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2019, Aug 28	Apollo NEA 2019 OU1 ($H = 23.1$ mag, $D \approx 90$ m) passed Earth at a nominal miss distance of 2.68 LD. Minimum miss distance 2.67 LD. See: 2019 OU1 - SSA , 2019 OU1 - JPL
2019, Aug 30	Discovery of interstellar comet C/2019 Q4 (Borisov) = I/Borisov. Perihelium at 2.01 AE on 8 December 2019. Close Earth approach at 1.9 AE late December 2019. See: https://ssd.jpl.nasa.gov/sbdb.cgi?ID=dK19Q040 https://www.iau.org/news/pressreleases/detail/iau1910/ https://commons.wikimedia.org/wiki/File:The_Solar_System_as_seen_from_interstellar_comet_Borisov_C2019_Q4.gif https://en.wikipedia.org/wiki/2I/Borisov
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2019, Sep 5	Apollo NEA 2019 RP1 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.099 LD (= 5.9 R_{Earth} from the geocenter). Minimum miss distance 0.098 LD. [2019-44] See: 2019 RP1 – SSA , 2019 RP1 - JPL Discovery station: Catalina Sky Survey See also: http://iawn.net/
2019, Sep 6	ESA NEOCC Newsletter : September 2019. See: http://neo.ssa.esa.int/newsletters
2019, Sep 7	Apollo NEA 2019 RC1 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.48 LD. Minimum miss distance 0.48 LD.

	[2019-45] See: 2019 RC1 – SSA , 2019 RC1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2019, Sep 21, 07:12	Apollo NEA 2019 SS2 ($H = 30.5$ mag, $D \approx 2.9$ m) passed Earth at a nominal miss distance of 0.30 LD. Minimum miss distance 0.30 LD. [2019-50] See: 2019 SS2 – SSA , 2019 SS2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Sep 22	Apollo NEA 2019 SS3 ($H = 26.4$ mag, $D \approx 19$ m) passed Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.73 LD. [2019-51] See: 2019 SS3 – SSA , 2019 SS3 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
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	instead run as a directed mission as part of the agency's planetary defense efforts. The spacecraft will have a total mass of no more than 1,300 kg, allowing it to launch on a vehicle like an Atlas 5 or Falcon 9 to the Sun–Earth Lagrange point L1. Foreseen launch date: late 2024. In 2005, the US Congress mandated NASA to achieve by the year 2020 a completeness level of 90% for discovering, cataloging, and characterizing dangerous asteroids larger than 140 meters. However, the 140-m NEO threat discovery estimate was just under 36% at the end of 2019. NEOSM should reach the 90% congressional goal within 10 years, with an anticipated mission lifetime of 12 years. See: https://spacenews.com/nasa-to-develop-mission-to-search-for-near-earth-asteroids/ See also: https://neocam.ipac.caltech.edu/ https://www.sciencemag.org/news/2019/09/nasa-build-telescope-detecting-asteroids-threaten-earth https://www.universetoday.com/143527/this-summers-asteroid-near-miss-helped-greenlight-nasas-neocam-mission-to-search-the-skies-for-killer-spacerocks/ https://www.space.com/nasa-to-build-near-earth-asteroid-hunter-telescope.html https://en.wikipedia.org/wiki/Near-Earth_Object_Surveillance_Mission
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2019, Sep 27	Apollo NEA 2006 QV89 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 18.02 LD. Minimum miss distance 18.02 LD. See: 2019 QV89 – SSA , 2019 QV89 – JPL See also: https://cneos.jpl.nasa.gov/news/news204.html http://neo.ssa.esa.int/newsletters [September]
2019, Sep 28, 07:50	Apollo NEA 2019 SX8 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2019-52] See: 2019 SX8 – SSA , 2019 SX8 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Sep 28, 20:33	Apollo NEA 2019 TE ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.93 LD. Minimum miss distance 0.88 LD. [2019-53] See: 2019 TE – SSA , 2019 TE - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Sep 29	Apollo NEA 2019 TD ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2019-54] See: 2019 TD – SSA , 2019 TD - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2019, Oct 3	Apollo NEA 2019 SP3 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.97 LD. Minimum miss distance 0.97 LD. [2019-56] See: 2019 SP3 – SSA , 2019 SP3 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
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2019, Oct 5	Apollo NEA 2019 TN5 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.32 LD. Minimum miss distance 0.32 LD. [2019-57] See: 2019 TN5 – SSA , 2019 TN5 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
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2019, Oct 10	National Academies of Sciences, Engineering, and Medicine, 2019, <i>Finding hazardous asteroids using infrared and visible wavelength telescopes</i> (Washington, DC: The National Academies Press) https://doi.org/10.17226/25476 . Contributors National Academies of Sciences, Engineering, and Medicine; Division on Engineering and Physical Sciences; Space Studies Board; Committee on Near Earth Object Observations in the Infrared and Visible Wavelengths. Description Near Earth objects (NEOs) have the potential to cause significant damage on Earth. In December 2018, an asteroid exploded in the upper atmosphere over the Bering Sea (western Pacific Ocean) with the explosive force of nearly 10 times that of the Hiroshima bomb. While the frequency of NEO impacts rises in inverse proportion to their sizes, it is still critical to monitor NEO activity in order to prepare defenses for these rare but dangerous threats. Currently, NASA funds a network of ground-based telescopes and a single, soon-to-expire space-based asset to detect and track large asteroids that could cause major damage if they struck Earth. This asset is crucial to NEO tracking as thermal-infrared detection and tracking of asteroids can only be accomplished on a space-based platform. <i>Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes</i> explores the advantages and disadvantages of infrared (IR) technology and visible wavelength observations of NEOs. This report reviews the techniques that could be used to obtain NEO sizes from an infrared spectrum and delineate the associated errors in determining the size. It also evaluates the strengths and weaknesses of these techniques and recommends the most valid techniques that give reproducible results with quantifiable errors.
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2019, Oct 18, 06:23	Apollo NEA 2019 UU1 ($H = 30.5$ mag, $D \approx 2.9$ m) passed Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.59 LD. [2019-58] See: 2019 UU1 – SSA , 2019 UU1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 16 Apr 1994 .
2019, Oct 18, 09:23	Apollo NEA 2019 UG ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2019-59] See: 2019 UG – SSA , 2019 UG - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2019, Oct 19	Apollo NEA 2019 UL3 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a

	nominal miss distance of 0.77 LD. Minimum miss distance 0.77 LD. [2019-60] See: 2019 UL3 – SSA , 2019 UL3 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2019, Oct 23	Apollo NEA 2019 UN8 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.94 LD. Minimum miss distance 0.93 LD. [2019-61] See: 2019 UN8 – SSA , 2019 UN8 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Oct 24	Z. Sekanina, 2019, e-print <i>arXiv:1910.11457</i> , “Note on the HST image of comet 2I/Borisov taken on 2019 October 12.” See: http://adsabs.harvard.edu/abs/2019arXiv191011457S
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	See also: http://www.qub.ac.uk/News/Allnews/Newfrontierforscienceasastronomersdetectgasmoleculesincometfromanotherstar.html
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2019, Oct 25, 13:30	Apollo NEA 2019 UO8 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.41 LD. Minimum miss distance 0.41 LD. [2019-62] See: 2019 UO8 – SSA , 2019 UO8 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 2 April 2016 .
2019, Oct 25, 17:21	Apollo NEA 162082 (1998 HL1) , $H = 19.1$ mag, $D \approx 500$ m, PHA) passed Earth at a nominal miss distance of 16.17 LD. Minimum miss distance 16.17 LD. See: 1998 HL1 – SSA , 1998 HL1 - JPL See also: http://neo.ssa.esa.int/newsletters [October, November] https://www.space.com/asteroid-1998-hl1-earth-flyby-october-2019-webcast.html
2019, Oct 26, 03:07	Apollo NEA 2019 UX12 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2019-63] See: 2019 UX12 – SSA , 2019 UX12 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 26 Oct 2065 .
2019, Oct 26, 22:02	Apollo NEA 2019 UJ12 ($H = 22.5$ mag, $D \approx 110$ m) passed Earth at a nominal miss distance of 7.16 LD. Minimum miss distance 7.15 LD. See: 2019 UJ12 – SSA , 2019 UJ12 – JPL
2019, Oct 27	Apollo NEA 2019 UD10 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [2019-64]

	See: 2019 UD10 - SSA , 2019 UD10 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Oct 29	Apollo NEA 2019 UB8 = 2019 US8 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.49 LD. [2019-65] See: 2019 UB8 – SSA , 2019 UB8 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Oct 31	Aten NEA 2019 UN13 ($H = 32.2$ mag, $D \approx 1.3$ m) passed Earth at a nominal miss distance of 0.033 LD (= 1.98 R_{Earth} from the geocenter). Minimum miss distance 0.032 LD (= 1.95 R_{Earth} from the geocenter). [2019-66] See: 2019 UN13 – SSA , 2019 UN13 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 2 Nov 2145. See also: http://neo.ssa.esa.int/newsletters [June 2020] https://en.wikipedia.org/wiki/2019_UN13
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2019, Nov 1	Apollo NEA 2019 UG11 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.55 LD. Minimum miss distance 0.55 LD. [2019-67] See: 2019 UG11 – SSA , 2019 UG11 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2019, Nov 2	Apollo NEA 2019 VA ($H = 28.4$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD.

	[2019-68] See: 2019 VA – SSA , 2019 VA - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 7 Nov 2016.
2019, Nov 4, 09:56	Apollo NEA 2019 VD ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [2019-69] See: 2019 VD – SSA , 2019 VD - JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/
2019, Nov 4, 10:30	Apollo NEA 2019 VR ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.35 LD. Minimum miss distance 0.35 LD. [2019-70] See: 2019 VR – SSA , 2019 VR - JPL Discovery station: ... See: http://iawn.net/
2019, Nov 5	ESA NEOCC Newsletter. November 2019. See: http://neo.ssa.esa.int/newsletters
2019, Nov 5-7	<i>Asteroid Science in the Age of Hayabusa2 and OSIRIS-REx Workshop</i>, 5-7 November 2019, Tucson (AZ, USA). See: https://corex.lpl.arizona.edu/international-workshop Program: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/asteroidscience2019_program.htm Among the oral papers: - M.A. Barucci, P.H. Hasselmann, M. Fulchignoni, et al., 2019, “Ryugu and Bennu: multivariate statistical analysis of spectral data obtained by the Hayabusa2 and OSIRIS-REx missions [#2039].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2039.pdf - E.B. Bierhaus, D. Trang, O.S. Barnouin, et al., 2019, “Impact craters on Bennu: their morphology, size-frequency distribution, and correlation with other data sets [#2129].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2129.pdf - W.F. Bottke, A. Moorhead, C.W. Hergenrother, et al., 2019, “Meteoroid impacts as the source of Bennu’s particle ejection events [#2064].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2064.pdf - S.R. Chesley, A.B. Davis, A.S. French, et al., 2019, “Trajectories of ejected particles in Bennu’s environment [#2124].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2124.pdf - B.E. Clark, S.M. Ferrone, H.H. Kaplan, et al., 2019, “Overview of the search for space weathering signals on the surface of Bennu: one

	rock type, or two? [#2125].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2125.pdf - R.T. Daly, E.B. Bierhaus, O.S. Barnouin, et al., 2019, “The variable depth-to-diameter ratios of candidate impact craters on Bennu: inferences and implications [#2030].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2030.pdf - D. Domingue, K. Kitazato, M. Matsuoka, et al., 2019, “Photometric properties of Ryugu’s the surface from both Hayabusa2 NIRS3 and ONC-T Instruments [#2104].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2104.pdf - C.A. Goodrich, M.E. Zolensky, A.M. Fioretti, et al., 2019, “Distinguishing differentiated dark asteroids from primitive dark asteroids: clues and cautions from asteroid 2008 TC3 and the Almahata Sitta Meteorite [#2107].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2107.pdf - M. Grott, J. Biele, P. Michel, et al., 2019, “Macro-porosity and grain density of C-type asteroid (162173) Ryugu [#2038].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2038.pdf - V.E. Hamilton, A.A. Simon, H.H. Kaplan, et al., 2019, “The global mineralogy of (101955) Bennu from VNIR and TIR observations during the detailed survey phase of the OSIRIS-REx mission [#2044].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2044.pdf - R.D. Hanna, V.E. Hamilton, C.W. Haberle, et al., 2019, “What is the hydrated phase on Bennu’s surface? [#2029].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2029.pdf - M. Hirabayashi, Y. Cho, T. Morota, et al., 2019, “Spin-driven evolution of top-shaped asteroids at fast and slow spins seen from (101955) Bennu and (162173) Ryugu [#2047].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2047.pdf - H.H. Kaplan, D.N. DellaGiustina, A.A. Simon, et al., 2019, “Detection of pyroxenes on Bennu with the OSIRIS-REx Visible and InfraRed Spectrometer [#2056].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2056.pdf - H. Kurokawa, T. Shibuya, Y. Sekine, B.L. Ehlmann, 2019, “Modeling of infrared reflectance spectra of volatile-rich asteroids [#2083].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2083.pdf - L.F. Lim, H.H. Kaplan, V.E. Hamilton, et al., 2019, “Main-belt infrared spectral analogues for (101955) Bennu: AKARI and Spitzer IRS asteroid spectra [#2121].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2121.pdf - V.R. Manga, T.J. Zega, K. Muralidharan, 2019, “Deduction the thermodynamic origins of planetary materials: implications for the histories of materials to be returned by Hayabusa2 and OSIRIS-REx [#2143].” See: https://www.hou.usra.edu/meetings/asteroidscience2019/pdf/2143.pdf - P. Michel, R.-L. Ballouz, O.S. Barnouin, et al., 2019, “Disruption

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2019, Nov 6	Apollo NEA 2019 VS4 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.36 LD. Minimum miss distance 0.36 LD. [2019-71] See: 2019 VS4 – SSA , 2019 VS4 - JPL Discovery station: ISON-Byurakan Observatory See: http://iawn.net/
2019, Nov 9, 17:29	Apollo NEA 2019 VB5 ($H = 31.7$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.38 LD. [2019-72] See: 2019 VB5 – SSA , 2019 VB5 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 25 Apr 2010.
2019, Nov 9, 23:16	Apollo NEA 2019 VF5 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2019-73] See: 2019 VF5 – SSA , 2019 VF5 - JPL

	Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 10 Nov 1990.
2019, Nov 11	E.G. Flekkøy, J.X. Luu, R. Toussaint, 2019, <i>Astrophysical Journal Letters</i>, 885, L41, “The interstellar object 'Oumuamua as a fractal dust aggregate.” See: https://ui.adsabs.harvard.edu/abs/2019ApJ...885L..41F/abstract
2019, Nov 13	Apollo NEA 2019 UN12 ($H = 22.2$ mag, $D \approx 130$ m) passed Earth at a nominal miss distance of 3.74 LD. Minimum miss distance 3.74 LD. See: 2019 UN12 – SSA , 2019 UN12 – JPL
2019, Nov 13	The “Goodbye Ryugu” campaign. On November 13, 2019 at 10:05 JST (onboard time), the Hayabusa2 spacecraft departed from asteroid Ryugu to return to Earth. Until November 18 ~ 19, images of the receding Ryugu will be captured by the camera mounted on the spacecraft. After this time, the spacecraft will perform an attitude control maneuver to the orientation needed to operate the ion engines and will no longer be able to take photographs of Ryugu. Asteroid sample return to Earth in December 2020. See: https://global.jaxa.jp/press/2019/11/20191113a.html http://www.hayabusa2.jaxa.jp/en/galleries/onc/nav20191113/ http://www.hayabusa2.jaxa.jp/en/topics/20191113e_SAYONARA_Ryugu/ https://www.space.com/hayabusa2-spacecraft-leaves-asteroid-ryugu.html See also 27 June 2018.
2019, Nov 15	M.W. Busch, S.J. Ostro, L.A.M. Benner, et al., 2019, <i>Icarus</i>, 333, 548, "Corrigendum to “Radar observations and the shape of near-Earth asteroid 2008 EV5” [<i>Icarus</i> 212 (2011) 649–660]." See: https://ui.adsabs.harvard.edu/abs/2019Icar..333..548B/abstract
2019, Nov 15	O.G. Gladysheva, 2019, <i>Planetary and Space Science</i>, 178, 104709, “Disintegration of the Chelyabinsk cosmic body.” See: http://adsabs.harvard.edu/abs/2019P%26SS..17804709G
2019, Nov 15	F.M. McCubbin, J.J. Barnes, 2019, <i>Earth and Planetary Science Letters</i>, 526, 115771, “Origin and abundances of H₂O in the terrestrial planets, Moon, and asteroids.” See: http://adsabs.harvard.edu/abs/2019E%26PSL.52615771M
2019, Nov 15	N. Moskovitz, P. Fatka, D. Farnocchia, et al., 2019, <i>Icarus</i>, 333, 165, "A common origin for dynamically associated Near-Earth Asteroid pairs."

	See: http://adsabs.harvard.edu/abs/2019Icar..333..165M
2019, Nov 15	K. Ogawa , M. Hamm, M. Grott, et al., 2019, <i>Icarus</i> , 333, 318, "Possibility of estimating particle size and porosity on Ryugu through MARA temperature measurements." See: https://ui.adsabs.harvard.edu/abs/2019Icar..333..318O/abstract
2019, Nov 15	S. Potin, P. Beck, B. Schmitt, F. Moynie, 2019, <i>Icarus</i> , 333, 415, "Some things special about NEAs: geometric and environmental effects on the optical signatures of hydration." See: http://adsabs.harvard.edu/abs/2019Icar..333..415P
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2019, Nov 15	L. Sokolov, G. Kuteeva, N. Petrov, B. Eskin, 2019, <i>AIP Conference Proceedings</i> , 2171, 130019, "Hazardous near-Earth asteroids approach." See: https://ui.adsabs.harvard.edu/abs/2019AIPC.2171m0019S/abstract
2019, Nov 15	X. Zeng, X. Li, D.J.P. Martin, et al., 2019, <i>Icarus</i> , 333, 371, "The Itokawa regolith simulant IRS-1 as an S-type asteroid surface analogue." See: https://ui.adsabs.harvard.edu/abs/2019Icar..333..371Z/abstract
2019, Nov 18	Z. Sekanina, 2019, e-print <i>arXiv</i> :1911.06271, "Sublimation of water ice from a population of large, long-lasting grains near the nucleus of 21/Borisov ?" See: https://ui.adsabs.harvard.edu/abs/2019arXiv191106271S/abstract
2019, Nov 18	Apollo NEA 2020 CD3 ($H = 31.8$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.75 LD. [2019-74] See: 2020 CD3 - S2P , 2020 CD3 – JPL Discovery station: calculated See also: 18 Sep 2017, 6 Dec 2017, 19 Feb 2018, 9 May 2018, 9 Aug 2018, 26 Oct 2018, 16 Jan 2019, 4 Apr 2019, 30 Jun 2019, 10 Sep 2019, 13 Feb 2020.
2019, Nov 19, 08:0	Apollo NEA 2019 WH ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.22 LD. Minimum miss distance 0.22 LD. [2019-75] See: 2019 WH – SSA , 2019 WH - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/

2019, Nov 19, 23:4	Apollo NEA 2019 WV1 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.72 LD. [2019-76] See: 2019 WV1 – SSA , 2019 WV1 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2019, Nov 21	Aten NEA 481394 (2006 SF6, $H = 19.7$ mag, $D \approx 400$ m, PHA) passed Earth at a nominal miss distance of 11.23 LD. Minimum miss distance 11.23 LD. See: 2006 SF6 – SSA , 2006 SF6 - JPL See also: http://neo.ssa.esa.int/newsletters (November) https://www.newsweek.com/enormous-asteroid-whiz-planet-tomorrow-1472726
2019, Nov 22	D. Jewitt, J. Luu, 2019, <i>Astrophysical Journal Letters</i>, 886, L29, “Initial characterization of interstellar comet 2I/2019 Q4 (Borisov).” See: https://ui.adsabs.harvard.edu/abs/2019ApJ...886L..29J/abstract
2019, Nov 22	N. Kiselev, N. Karpov, O. Ivanova, et al., 2019, <i>Research Notes of the American Astronomical Society</i>, 3, 178, “Polarimetry and photometry of the NEA (162082) 1998 HL1.” See: https://ui.adsabs.harvard.edu/abs/2019RNAAS...3..178K/abstract
2019, Nov 23	Apollo NEA 2019 WG2 ($H = 25.1$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 0.47 LD. Minimum miss distance 0.47 LD. [2019-77] See: 2019 WG2 – SSA , 2019 WG2 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
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2019, Nov 26	ESA Council meeting at ordinary level, Sevilla (Spain). See: https://www.esa.int/About_Us/Welcome_to_ESA/ESA_on_the_way_to_Space19_and_beyond
2019, Nov 26	M. Gannon, 2019, <i>Space.com</i>, 26 November 2019, “Will Europe finally get its asteroid-deflection mission off the ground?” See: https://www.space.com/hera-asteroid-deflection-mission-european-support.html

	See also: https://videos.space.com/m/23qvbGX9/esa-hera-mission-to-test-asteroid-deflection-technique-overview?list=9wzCTV4g https://www.space.com/hera-self-driving-spacecraft-asteroid-defense.html https://www.space.com/19933-asteroid-deflection-mission-aida-didymos.html https://www.space.com/brian-may-video-asteroid-mission-hera.html
2019, Nov 26	J. Shelton, 2019, <i>Yale News</i>, 26 November 2016, “New image offers close-up view of interstellar comet.” See: https://news.yale.edu/2019/11/26/new-image-offers-close-view-interstellar-comet See also: https://www.space.com/interstellar-comet-borisov-photo-keck-observatory.html
2019, Nov 27-28	ESA Council meeting at ministerial level, called '<i>Space19+</i>', Sevilla (Spain). See: https://www.esa.int/About_Us/Welcome_to_ESA/ESA_on_the_way_to_Space19_and_beyond http://blogs.esa.int/space19plus/ http://esamultimedia.esa.int/docs/corporate/Space19+flyers_SSA_LR.pdf https://www.esa.int/Safety_Security/Hera https://mailchi.mp/asteroidday/asteroid-day-62-hera-puerto-rico-fiaschetti-tomorrow-street?e=db8a8b6284 https://www.esa.int/About_Us/Corporate_news/Record_funding_for_European_space_investments_in_Seville https://www.esa.int/Newsroom/Press_Releases/ESA_ministers_commit_to_biggest_ever_budget
2019, Nov 30, 03:0	Apollo NEA 2019 WQ3 ($H = 22.6$ mag, $D \approx 110$ m) passed Earth at a nominal miss distance of 9.66 LD. Minimum miss distance 9.65 LD. See: 2019 WQ3 – SSA , 2019 WQ3 - JPL
2019, Nov 30, 20:0	Apollo NEA 2019 WJ4 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.85 LD. Minimum miss distance 0.85 LD. [2019-78] See: 2019 WJ4 – SSA , 2019 WJ4 - JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/
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2019, Dec	F. Scholten, F. Preusker, S. Elgner, et al., 2019b, <i>Astronomy & Astrophysics, Letter</i> , 632, L5, “The Hayabusa2 lander MASCOT on the surface of asteroid (162173) Ryugu - stereo-photogrammetric analysis of MASCam image data.” See: https://ui.adsabs.harvard.edu/abs/2019A%26A...632L...5S/abstract
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2019, Dec 3	J. Liu, J. Zheng, M. Li, 2019, <i>Astrophysics and Space Science</i> , 364, 215, “Dry mass optimization for the impulsive transfer trajectory of a near-Earth asteroid sample return mission.” See: https://ui.adsabs.harvard.edu/abs/2019Ap%26SS.364..215L/abstract
2019, Dec 4	M.-T. Hui, M.M. Knight, 2019, <i>Astronomical Journal</i> , 158, 256, “New insights into interstellar object 1I/2017 U1 (‘Oumuamua) from SOHO/STEREO nondetections.” See: https://ui.adsabs.harvard.edu/abs/2019AJ....158..256H/abstract
2019, Dec 5	ESA NEOCC Newsletter . December 2019. Among the items: * The ESA Ministerial Council took place in Seville (Spain) on 27-28 November. Budgets for the various ESA programmes were approved for the coming three years. In particular, the Space Safety Programme (S2P) has been adopted as the successor of the Space Situational Awareness (SSA) programme. * ESA’s Planetary Defence contribution to the AIDA mission has been adopted. This includes the approval for implementation of the Hera mission for a nominal launch date in October 2024. See: http://neo.ssa.esa.int/newsletters
2019, Dec 6	D.S. Lauretta, C.W. Hergenrother, S.R. Chesley, et al., 2019, <i>Science</i> , 366, eaay3544, “Episodes of particle ejection from the surface of the active asteroid (101955) Bennu .” See: https://ui.adsabs.harvard.edu/abs/2019Sci...366.3544L/abstract See also: https://www.jpl.nasa.gov/news/news.php?feature=7553 https://www.wired.com/story/no-one-knows-why-rocks-are-exploding-from-asteroid-bennu/
2019, Dec 8	S. Mathewson, 2019, <i>Space.com</i> , 8 December 2019, “Interstellar comet Borisov makes closest approach to the Sun.” See: https://www.space.com/interstellar-comet-borisov-perihelion-

	telescope-viewing.html See also: https://www.skyandtelescope.com/astronomy-news/will-amateurs-be-able-to-see-the-new-interstellar-comet/
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	See: https://apod.nasa.gov/apod/astropix.html
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2019, Dec 18	S. Kohler, 2019, <i>AAS Nova Highlight</i> , 18 December 2019, id.6062, "Selections from 2019: Explanation for an interstellar visitor." See: https://ui.adsabs.harvard.edu/abs/2019nova.pres.6062K/abstract
2019, Dec 18, 00:11	Apollo NEA 2019 YB ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.43 LD. [2019-79] See: 2019 YB – S2P , 2019 YB – JPL Discovery station: ... See: http://iawn.net/
2019, Dec 18, 15:11	Apollo NEA 2019 YS ($H = 31.5$ mag, $D \approx 1.8$ m) passed Earth at a nominal miss distance of 0.17 LD. Minimum miss distance 0.17 LD. [2019-80] See: 2019 YS – S2P , 2019 YS – JPL Discovery station: ... See: http://iawn.net/
2019, Dec 23	V.V. Ivashkin, P. Guo, 2019, <i>Doklady Physics</i> , 64, 418, "Analysis of the possibility of creating a stable satellite of the asteroid Apophis as a homogeneous triaxial ellipsoid." See: https://ui.adsabs.harvard.edu/abs/2019DokPh..64..418I/abstract
2019, Dec 23	Apollo NEA 2019 YU2 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.26 LD. Minimum miss distance 0.26 LD. [2019-81] See: 2019 YU2 – S2P , 2019 YU2 – JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2019, Dec 25	Apollo NEA 2019 YV4 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.98 LD. Minimum miss distance 0.89 LD. [2019-82] See: 2019 YV4 – S2P , 2019 YV4 – JPL Discovery station: Kitt Peak-Bok See: http://iawn.net/

2019, Dec 27	R. Hyodo, K. Kurosawa, H. Genda, 2019, <i>Scientific Reports</i> , 9, 19833, “Transport of impact ejecta from Mars to its moons as a means to reveal Martian history.” See: https://ui.adsabs.harvard.edu/abs/2019NatSR...919833H/abstract
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2020, Jan	O.S. Barnouin, M.G. Daly, E.E. Palmer, et al., 2020, <i>Planetary and Space Science</i> , 180, 104764, “Digital terrain mapping by the OSIRIS-REx mission.” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..18004764B/abstract
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2020, Jan 17	P.M. Hull, A. Bornemann, D.E. Penman, et al., 2020, <i>Science</i>, 367, 266, “On impact and volcanism across the Cretaceous-Paleogene boundary.” See: https://science.sciencemag.org/content/367/6475/266 See also: https://www.space.com/asteroid-wiped-out-dinosaurs-volcanic-eruption-life.html
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2020, Jan 17	Apollo NEA 2020 AN3 ($H = 20.4$ mag, $D \approx 290$ m, PHA) passed Earth at a nominal miss distance of 7.92 LD. Minimum miss distance 7.92 LD. See: 2020 AN3 – S2P , 2020 AN3 – JPL See also: 15 Jan 2055.
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2020, Jan 20	Apollo NEA 2020 BK3 ($H = 26.9$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.78 LD. Minimum miss distance 0.78 LD. [2020-02] See: 2020 BK3 – S2P , 2020 BK3 – JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/

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2020, Jan 22	Apollo NEA 2020 BB5 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.69 LD. Minimum miss distance 0.69 LD. [2020-03] See: 2020 BB5 – S2P , 2020 BB5 – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Jan 23	D.R. Golish, C. Drouet d’Aubigny, B. Rizk, et al., 2020, <i>Space Science Reviews</i>, 216, 12, “Ground and in-flight calibration of the OSIRIS-REx camera suite.” See: https://ui.adsabs.harvard.edu/abs/2020SSRv..216...12G/abstract
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2020, Jan 27	H.W. Lin, C.-H. Lee, D.W. Gerdes, et al., 2020, <i>Astrophysical Journal Letters</i>, 889, “Detection of diatomic carbon in 2I/Borisov.” See: https://ui.adsabs.harvard.edu/abs/2020ApJ...889L..30L/abstract
2020, Jan 27	Apollo NEA 2020 BA13 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.51 LD. Minimum miss distance 0.51 LD. [2020-05] See: 2020 BA13 – S2P , 2020 BA13 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2020, Jan 28	P.R. Heck, J. Greer, L. Kööp, et al., 2020, <i>Proceedings of the National Academy of Sciences of the United States of America</i>, 117, 1884, “Lifetimes of interstellar dust from cosmic ray exposure ages of presolar silicon carbide.” See: https://www.pnas.org/content/117/4/1884 https://doi.org/10.1073/pnas.1904573117 See also: http://nccr-planets.ch/blog/2020/01/13/meteorite-contains-the-oldest-material-on-earth/ https://www.space.com/stardust-oldest-material-on-earth.html
2020, Jan 28	Apollo NEA 2020 BA15 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.98 LD. Minimum miss distance 0.98 LD. [2020-06] See: 2020 BA15 – S2P , 2020 BA15 – JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2020, Jan 29	Apollo NEA 2020 BZ13 ($H = 29.9$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2020-07] See: 2020 BZ13 – S2P , 2020 BZ13 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2020, Jan 31, 03:51	Apollo NEA 2020 CZ ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.82 LD. [2020-08] See: 2020 CZ – S2P , 2020 CZ - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Jan 31, 19:03	Apollo NEA 2020 CJ ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.92 LD. [2020-09] See: 2020 CJ – S2P , 2020 CJ – JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
2020, Feb	C.A.L. Bailer-Jones, D. Farnocchia, Q. Ye, et al., 2020, <i>Astronomy & Astrophysics</i> , 634, 14, “A search for the origin of the interstellar comet 2I/Borisov .” See: https://ui.adsabs.harvard.edu/abs/2020A%26A...634A..14B/abstract
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2020, Feb 2	Aten NEA 2020 CA ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.57 LD. [2020-11] See: 2020 CA – S2P , 2020 CA – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 4 Feb 2179 .
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2020, Feb 3,08:19	Apollo NEA 2020 BT14 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2020-12] See: 2020 BT14 – S2P , 2020 BT14 – JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/ See also: 3 Feb 2087 .

2020, Feb 3,18:56	Binary Apollo NEA 2020 BX12 ($H = 20.7$ mag, $D \approx 250$ m, PHA) passed Earth at a nominal miss distance of 11.34 LD. Minimum miss distance 11.34 LD. See: 2020 BX12 – S2P , 2020 BX12 – JPL See also: https://www.space.com/near-earth-binary-asteroid-2020-bx12-has-moon.html https://en.wikipedia.org/wiki/2020_BX12
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	report.” See: https://www.cosmos.esa.int/documents/336356/336472/SMPAG_status_-_Drolshagen_2020-02-06.pdf/ - L. Johnson, 2020, “Planetary Defense Coordination Office.” See: https://www.cosmos.esa.int/documents/336356/336472/PDCO_Brief_to_SMPAG_-_Johnson_2020-02-06+%281%29.pdf/ - D. Koschny, 2020, “ESA's new Space Safety Programme.” See: https://www.cosmos.esa.int/documents/336356/336472/ESAs_Space_Safety_programme_-_Koschny_2020-02-06+%283%29.pdf/ - M. Vasile, 2020, “Task 5.2 and UK activities.” See: https://www.cosmos.esa.int/documents/336356/336472/UK_Task+5_-_Vasile_2020-02-06.pdf/ - M. Yoshikawa and Hayabusa2 ProjectTeam, 2020, “Asteroid sample return mission Hayabusa2.” See: https://www.cosmos.esa.int/documents/336356/336472/Hayabusa2_2020-02-06.pdf/ - L. Johnson, 2020, “OSIRIS-REx status – 2020 ‘The Year of TAG’.” See: https://www.cosmos.esa.int/documents/336356/336472/SMPAG_OREx_Update_-_Johnson_2020-02-06+%281%29.pdf/ - L. Johnson, 2020, “DART update.” See: https://www.cosmos.esa.int/documents/336356/336472/SMPAG_DART_Update_-_Johnson_2020-02-06+%281%29.pdf/ - Carnelli, 2020, “Hera mission.” See: https://www.cosmos.esa.int/documents/336356/336472/Hera_status_-_Koschny_2020-02-06+%282%29.pdf/ - G. Jones, C. Snodgrass, and the Comet Interceptor Team, 2020, “Comet Interceptor, an ESA mission to an ancient world.” See: https://www.cosmos.esa.int/documents/336356/336472/Comet_interceptor_-_presented_by_Koschny_2020-02-06+%281%29.pdf/ - T. Arai and Destiny+ Team , 2020, “Destiny+” . See: https://www.cosmos.esa.int/documents/336356/336472/DESTINY%2B_-_Yoshikawa_2020-02-06+%281%29.pdf/ - R. Kofler, 2020, “Erice school on NEOs.” See: https://www.cosmos.esa.int/documents/336356/336472/Erice_school_on_NEOs_-_Kofler_2020-06-02+%281%29.pdf/ - P. Michel, “Near Earth Object Modelling and Payloads for Protection - NEO-MAPP.” See: https://www.cosmos.esa.int/documents/336356/336472/NEO-MAPP_2020-06-02+%281%29.pdf/ Tasks from work plan - C. Colombo, 2020, Task 5.2 to 5.4. - M. Fruehauf, R. Jehn, D. Koschny, 2020, Task 5.3, “Mapping of the threat scenarios to mission types.” See: https://www.cosmos.esa.int/documents/336356/336472/ESA-S2P-PD-HO-0002_1_2_Mapping_of_threat_scenarios_to_mission_types_2020-02-06+%282%29.pdf/ - R. Albrecht, 2020, Task 5.8, “Consequences, including failure”

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2020, Feb 13, 13:22	Apollo NEA 2020 DU ($H = 28.7$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.85 LD. Minimum miss distance 0.84 LD. [2020-14] See: 2020 DU – S2P , 2020 DU - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Feb 13, 16:20	Apollo NEA 2020 CD3 ($H = 31.8$ mag, $D \approx 1.6$ m) passed Earth at a nominal miss distance of 0.12 LD. Minimum miss distance 0.12 LD. [2020-15] See: 2020 CD3 – S2P , 2020 CD3 - JPL Discovery station: Mt. Lemmon Survey See: https://minorplanetcenter.net/mpec/K20/K20DA4.html See also: 18 Sep 2017, 6 Dec 2017, 19 Feb 2018, 9 May 2018, 9 Aug 2018, 26 Oct 2018, 16 Jan 2019, 4 Apr 2019, 30 Jun 2019, 10 Sep 2019, 18 Nov 2019. See also: https://twitter.com/WierzchosKacper/status/1232460436634656769 https://cneos.jpl.nasa.gov/news/news205.html https://www.nationalastro.org/news/gemini-telescope-images-minimoon-orbiting-earth-in-color/ https://www.theatlantic.com/science/archive/2020/02/mini-moon-earth/607171/ https://earthsky.org/space/new-natural-temporary-moon-for-earth-2020-cd3 https://www.newscientist.com/article/2235427-earth-has-acquired-a-brand-new-moon-thats-about-the-size-of-a-car/ https://www.space.com/mini-moon-2020-cd3-discovered.html https://www.space.com/minimoon-2020-cd3-discovery-around-earth-explained.html https://videos.space.com/m/1fxT4Hwc/earth-has-a-new-mini-moon-temporarily-see-its-orbit http://neo.ssa.esa.int/newsletters (March 2020) https://www.theatlantic.com/science/archive/2020/03/mini-moon-earth-lost/608455/ https://en.wikipedia.org/wiki/2020_CD3
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2020, Feb 14	Aten NEA 2020 CQ2 ($H = 28.7$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2020-16] See: 2020 CQ2 – S2P , 2020 CQ2 - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
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2020, Feb 17	Apollo NEA 2020 DP14 ($H = 30.4$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.31 LD. Minimum miss distance 0.31 LD. [2020-17] See: 2020 DP14 – S2P , 2020 DP14 – JPL See also: 17 Feb 2020.
2020, Feb 18, 10:32	Apollo NEA 2020 DA1 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.50 LD. Minimum miss distance 0.50 LD. [2020-18] See: 2020 DA1 – S2P , 2020 DA1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 18 Feb 2006.
2020, Feb 18, 17:02	Aten NEA 2020 DW ($H = 30.2$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.63 LD. Minimum miss distance 0.63 LD. [2020-19] See: 2020 DW – S2P , 2020 DW - JPL Discovery station: Mt. Lemmon Survey See: https://www.minorplanetcenter.net/mpec/K20/K20D44.html
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	meteorite.html&hl=en&geo=US
2020, Feb 25, 07:15	Apollo NEA 2020 DV3 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 1.06 LD. Minimum miss distance 1.06 LD. See: 2020 DV3 – S2P , 2020 DV3 - JPL
2020, Feb 25, 20:30	Aten NEA 2020 DR4 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.24 LD. Minimum miss distance 0.24 LD. [2020-20] See: 2020 DR4 – S2P , 2020 DR4 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 24 Feb 2059 .
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2020, Apr 3	Apollo NEA 2020 GH ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.33 LD. Minimum miss distance 0.33 LD. [2020-28] See: 2020 GH – S2P , 2020 GH - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/

2020, Apr 5, 07:37	Apollo NEA 2020 GY1 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.21 LD. Minimum miss distance 0.21 LD. [2020-29] See: 2020 GY1 – S2P , 2020 GY1 - JPL Discovery station: Tokyo-Kiso See: http://iawn.net/ See also: 2 Apr 1913, 5 Apr 2033.
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2020, Apr 6	Q. Zhang, Q. Ye, L. Kolokolova, 2020, <i>Atel</i> #13618, “Interstellar comet 2I/Borisov is single again.” See: http://www.astronomerstelegam.org/?read=13618 https://ui.adsabs.harvard.edu/abs/2020ATel13618....1Z/abstract
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2020, Apr 10	G. Cremonese, M. Fulle, P. Cambianica, et al., 2020, <i>Astrophysical Journal Letters</i>, 893, L12, “Dust environment model of the interstellar comet 2I/Borisov.” See: https://ui.adsabs.harvard.edu/abs/2020ApJ...893L..12C/abstract
2020, Apr 11	L. Dimare, A. Del Vigna, D. Bracali Cioci, F. Bernardi, 2020, <i>Celestial Mechanics and Dynamical Astronomy</i>, 132, 20, “Use of the semilinear method to predict the impact corridor on ground.” See: https://ui.adsabs.harvard.edu/abs/2020CeMDA.132...20D/abstract

2020, Apr 11, 15:57	Apollo NEA 2020 GA2 ($H = 21.1$ mag, $D \approx 210$ m, PHA) passed Earth at a nominal miss distance of 8.54 LD. Minimum miss distance 8.51 LD. See: 2020 GA2 – S2P , 2020 GA2 - JPL See also: 13 Apr 2162.
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2020, Apr 15, 10:06	Apollo NEA 2020 HO ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.75 LD. [2020-30] See: 2020 HO – S2P , 2020 HO - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, Apr 15, 12:47	Apollo NEA 2020 GH2 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.93 LD. Minimum miss distance 0.93 LD. [2020-31] See: 2020 GH2 – S2P , 2020 GH2 - JPL

	Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: https://www.space.com/house-size-asteroid-2020-gh2-earth-flyby-april-2020.html
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2020, Apr 20-22	Hera Community Workshop, ~~20-22 April 2020~~, Nice (France). Rescheduled for: 11-13 November 2020. See: https://www.cosmos.esa.int/web/hera-community-workshop/
2020, Apr 21	S. Bouquillon, D. Souami, 2020, <i>Proceeding 8th ADeLA meeting</i>, 2018, Tarija (Bolivia), e-print <i>arXiv:2004.09961</i>, “The GBOT asteroid survey (First years: Jan. 2015 - May 2018).” See: https://ui.adsabs.harvard.edu/abs/2020arXiv200409961B/abstract

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2020, Apr 22, 05:52	Apollo NEA 2020 HM6 ($H = 26.6$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2020-32] See: 2020 HM6 – S2P , 2020 HM6 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Apr 22, 16:41	Apollo NEA 2020 HF5 ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.38 LD. [2020-33] See: 2020 HF5 – S2P , 2020 HF5 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 26 Apr 1975, 26 Apr 2079.
2020, Apr 22, 20:19	Apollo NEA 2020 HU7 ($H = 29.7$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.34 LD. [2020-34] See: 2020 HU7 – S2P , 2020 HU7 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Apr 23-24	Apophis T-9 Years: Knowledge Opportunities for the Science of Planetary Defense workshop , Nice (France). 23-24 April 2020. Rescheduled for: 9-10 November 2020. See: https://www.hou.usra.edu/meetings/apophis2020/
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2020, Apr 24	Apollo NEA 2020 HX3 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.66 LD. Minimum miss distance 0.66 LD. [2020-35] See: 2020 HX3 – S2P , 2020 HX3 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 24 Apr 2006. See also: https://www.space.com/house-size-asteroid-2020-gh2-earth-flyby-april-2020.html
2020, Apr 26	D. Garcia-Castellanos, 2020, <i>Space.com</i>, 26 April 2020, “Tomanowos, the meteorite that survived mega-floods and human folly.” See: https://theconversation.com/tomanowos-the-meteorite-that-survived-mega-floods-and-human-folly-134213 See also: https://www.space.com/tomanowos-meteorite-survived-mega-floods-human-folly.html https://www.amnh.org/exhibitions/permanent/the-universe/planets/planetary-impacts/the-willamette-meteorite
2020, Apr 26, 04:03	Apollo NEA 2020 HY5 ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 16.28 LD. Minimum miss distance 16:15 LD. See: 2020 HY5 – S2P , 2020 HY5 – JPL See also: http://neo.ssa.esa.int/newsletters [June 2020] http://neo.ssa.esa.int/neocc-riddles https://neo.ssa.esa.int/documents/20126/9041479/ESA-S2P-PD-RDL-0001_1_0_Riddle_01_2020-06-04.pdf/04a0277c-53a3-0a9a-70d4-c49f543c6277?t=1594309615255
2020, Apr 26, 13:33	Apollo NEA 2020 HT8 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.38 LD. [2020-36] See: 2020 HT8 – S2P , 2020 HT8 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, Apr 27	Z. Xing, D. Bodewits, J. Noonan, M.T. Bannister, 2020, <i>Astrophysical Journal Letters</i>, 893, L48, “Water production rates and activity of interstellar comet 2I/Borisov.” See: https://ui.adsabs.harvard.edu/abs/2020ApJ...893L..48X/abstract See also: http://astrobiology.com/2020/01/water-production-rates-and-activity-of-interstellar-comet-2iborisov.html

2020, Apr 27, 14:40	Apollo NEA 2020 HP6 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.33 LD. Minimum miss distance 0.33 LD. [2020-37] See: 2020 HP6 – S2P , 2020 HP6 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, Apr 28	D. Takir, T. Kareta, J.P. Emery, et al., 2020, <i>Nature Communications</i>, 11, 2050, “Near-infrared observations of active asteroid (3200) Phaethon reveal no evidence for hydration.” See: https://ui.adsabs.harvard.edu/abs/2020NatCo..11.2050T/abstract
2020, Apr 28	Johannes Andersen (1943-2020), General Secretary 1997-2000 of the International Astronomical Union, passed away on 28 April 2020 in Copenhagen (Denmark). Among his many achievements, on behalf of the IAU, he took part in meetings of the United Nations Committee on the Peaceful Uses of Outer Space between 1997 and 2003, when the Committee began to give serious consideration to the potential threat from Near-Earth Objects. See: https://www.iau.org/news/announcements/detail/ann20015/?lang
2020, Apr 28, 18:49	Apollo NEA 2020 HS7 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.11 LD. Minimum miss distance 0.11 LD. [2020-38] See: 2020 HS7 – S2P , 2020 HS7 - JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/ See also: https://www.nasa.gov/feature/small-asteroid-to-safely-fly-by-earth/ https://www.esa.int/Safety_Security/An_Agency_for_asteroids https://www.space.com/small-asteroid-2020-hs7-buzzes-earth-ahead-of-big-space-rock.html
2020, Apr 29	Amor NEA 52768 (1998 OR2, H = 16.0 mag, D ≈ 2100 m, PHA) passed Earth at a nominal miss distance of 16.36 LD. Minimum miss distance 16.36 LD. See: 1998 OR2 – SSA , 1998 OR2 – JPL See also: https://www.space.com/asteroid-1998-or2-earth-flyby-april-2020.html http://neo.ssa.esa.int/newsletters [3 April 2020] http://neo.ssa.esa.int/newsletters [23 April 2020] https://www.space.com/asteroid-1998-or2-photo-arecibo-observatory-april-2020.html https://www.jpl.nasa.gov/news/news.php?feature=7649&utm_source=iContact&utm_medium=email&utm_campaign=nasajpl&utm_content=daily20200428-2 https://cneos.jpl.nasa.gov/news/news206.html https://www.space.com/asteroid-1998-or2-earth-flyby-no-danger.html

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2020, Apr 30	Aten NEA 2020 JG ($H = 25.9$ mag, $D \approx 24$ m) passed Earth at a nominal miss distance of 0.56 LD. Minimum miss distance 0.55 LD. [2020-39] See: 2020 JG – S2P , 2020 JG – JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/ See also: 30 Apr 1922.
2020, May	M.A. Barucci, P.H. Hasselmann, A. Praet, et al., 2020, <i>Astronomy & Astrophysics, Letters</i>, 637, L4, “OSIRIS-REx spectral analysis of (101955) Bennu by multivariate statistics,” See: https://ui.adsabs.harvard.edu/abs/2020A%26A...637L...4B/abstract
2020, May	C. de la Fuente Marcos, R. de la Fuente Marcos, 2020a, <i>Monthly Notices of the Royal Astronomical Society: Letters</i>, 494, L6, “On the orbital evolution of 2020 AV2, the first asteroid ever observed to go around the Sun inside the orbit of Venus.” See: https://ui.adsabs.harvard.edu/abs/2020MNRAS.494L...6D/abstract See also: https://physicstoday.scitation.org/doi/10.1063/PT.6.1.20200416a/full/
2020, May	C. de la Fuente Marcos, R. de la Fuente Marcos, 2020b, <i>Monthly Notices of the Royal Astronomical Society</i>, 494, 1089, “On the orbital evolution of meteoroid 2020 CD3, a temporarily-captured orbiter of the Earth-Moon system.” See: https://ui.adsabs.harvard.edu/abs/2020MNRAS.494.1089D/abstract
2020, May	E. Drolshagen, T. Ott, D. Koschny, et al., 2020, <i>Planetary and Space Science</i>, 184, 104869, “Velocity distribution of larger meteoroids and small asteroids impacting Earth.” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..18404869D/abstract
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	https://academic.oup.com/mnras/article-abstract/494/1/680/5805210 https://ui.adsabs.harvard.edu/abs/2020MNRAS.tmp..673J/abstract
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2020, May	A. Skulteti, A. Kereszturi, M. Szabo, et al., 2020, <i>Planetary and Space Science</i> , 184, 104855, “Mid-infrared spectroscopic investigation of meteorites and perspectives for thermal infrared observations at the binary asteroid Didymos .” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..18404855S/abstract
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2020, May 1	J. Moeyens, N. Myhrvold, Ž. Ivezić, 2020, <i>Icarus</i> , 341, 113575, “ ATM : an open-source tool for Asteroid Thermal Modeling and its application to NEOWISE data.” See: https://ui.adsabs.harvard.edu/abs/2020Icar..34113575M/abstract
2020, May 2	J. O’Callaghan, 2020, <i>New Scientist</i> , 246, 10, “A glut of interstellar asteroids?” See: https://ui.adsabs.harvard.edu/abs/2020NewSc.246...10O/abstract
2020, May 3	Apollo NEA 2020 JA ($H = 27.3$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2020-40] See: 2020 JA – S2P , 2020 JA – JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, May 4	P. Michel, 2020, Annual Report 2019 IAU Working Group on Near Earth Objects . See: https://www.iau.org/static/science/scientific_bodies/divisions/f/division-f-annual-report-2019.pdf
2020, May 4	E. Rondón, D. Lazzaro, T. Rodrigues, et al., 2020, <i>Publications of the</i>

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2020, May 4	Apollo NEA 2020 JJ ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.035 LD (= 2.104 R_{Earth} from the geocenter). Minimum miss distance 0.035 LD. [2020-40] See: 2020 JJ – S2P , 2020 JJ - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: http://neo.ssa.esa.int/newsletters [June 2020] https://en.wikipedia.org/wiki/2020_JJ
2020, May 5	Apollo NEA 2020 JN ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2020-41] See: 2020 JN – S2P , 2020 JN - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2020, May 5	ESA NEOCC Newsletter. May 2020. See: http://neo.ssa.esa.int/newsletters
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2020, May 7	Apollo NEA 438908 (2009 XO, $H = 20.1$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 8.83 LD. Minimum miss distance 8.83 LD. See: 2009 XO - SSA , 2009 XO - JPL See also: 7 May 2096. See also: http://neo.ssa.esa.int/newsletters [June 2020]
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2020, May 9	Aten/Apollo NEA 2021 GM1 ($H = 30.5$ mag, $D \approx 2.9$ m) passed Earth at a nominal miss distance of 0.71 LD. Minimum miss distance 0.70 LD. [2020-42] See: 2021 GM1 – S2P , 2021 GM1 - JPL
2020, May 14	Asteroids & Beyond: <i>The B612 Foundation Newsletter</i> Vol. 44. See: https://mailchi.mp/b612foundation/asteroids-beyond-the-b612-foundation-newsletter-vol-44?e=b8e2af394f
2020, May 10	Apollo NEA 388945 (2008 TZ3 , $H = 20.5$ mag, $D \approx 280$ m, PHA) passed Earth at a nominal miss distance of 7.27 LD. Minimum miss distance 7.27 LD. See: 388945 2008 TZ3 - SSA , 2008 TZ3 - JPL See also: 9 May 2018 . See also: http://neo.ssa.esa.int/newsletters [June 2020]
2020, May 12	Q. Hoi Shan Chan, R. Stroud, Z. Martins, H. Yabuta, 2020, <i>Space Science Reviews</i> , 216, 56, “Concerns of organic contamination for sample return space missions.” See: https://ui.adsabs.harvard.edu/abs/2020SSRv..216...56C/abstract
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2020, May 12	Apollo NEA 2000 KA ($H = 21.9$ mag, $D \approx 150$ m, PHA) passed Earth at a nominal miss distance of 8.84 LD. Minimum miss distance 8.84 LD. See: 2000 KA - SSA , 2000 KA - JPL See also: 27 Nov 2128 , 15 May 2158 .
2020, May 13	R. Villanueva, J. Ricra, M. Zegarra-Valles, et al., 2020, <i>Atel</i> #13733, “Astrometric observations of the Potentially Hazardous Asteroid (52768) 1998 OR2 near its maximum approach to Earth.” See: http://www.astronomerstelegam.org/?read=13733 See also: 29 Apr 2020 .
2020, May 15	R.C. Greenwood, T.H. Burbine, I.A. Franchi, 2020, <i>Geochimica et Cosmochimica Acta</i> , 277, 377, “Linking asteroids and meteorites to

	the primordial planetesimal population.” See: https://ui.adsabs.harvard.edu/abs/2020GeCoA.277..377G/abstract
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2020, May 20	D. Marčeta, B. Novaković, 2020, <i>Monthly Notices of the Royal Astronomical Society</i> , staa1378, Accepted manuscript, “Retrograde orbits excess among observable interstellar objects.” See: https://ui.adsabs.harvard.edu/abs/2020MNRAS.tmp.1517M/abstract
2020, May 22	M. Li, Y. Wang, Y. Wang, et al., 2020, <i>Nature Scientific Reports</i> , 10, 8506, “Enhanced Kinetic Impactor for deflecting large Potentially Hazardous Asteroids via maneuvering space rocks.” See: https://ui.adsabs.harvard.edu/abs/2020NatSR..10.8506L/abstract
2020, May 22	E. Salguero-Hernández, L. Pérez-Cruz, J. Urrutia-Fucugauchi, 2020, <i>Acta Geophysica</i> , 68, 627, “Seismic attribute analysis of Chicxulub impact crater .” See: https://link.springer.com/article/10.1007%2Fs11600-020-00442-z
2020, May 23	Apollo NEA 2020 KU ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 1.01 LD. Minimum miss distance 1.01 LD. See: 2020 KU – S2P , 2020 KU – JPL
2020, May 26	G.S. Collins, N. Patel, T.M. Davison, et al., 2020, <i>Nature Communications</i> , 11, 1480, “A steeply-inclined trajectory for the Chicxulub impact .” See: https://ui.adsabs.harvard.edu/abs/2020NatCo..11.1480C/abstract
2020, May 26	D. Janches, J.S. Bruzzone, R.J. Weryk, et al., 2020, <i>Astrophysical Journal Letters</i> , 895, L25, “Observations of an unexpected meteor shower outburst at high ecliptic southern latitude and its potential origin.” See: https://ui.adsabs.harvard.edu/abs/2020ApJ...895L..25J/abstract
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2020, May 28, 12:4	Apollo NEA 2020 KF5 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.64 LD. Minimum miss distance 0.64 LD. [2020-43]

	See: 2020 KF5 – S2P , 2020 KF5 – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, May 28, 13:2	Aten NEA 2020 KJ4 ($H = 29.9$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.37 LD. Minimum miss distance 0.37 LD. [2020-44] See: 2020 KJ4 – S2P , 2020 KJ4 – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 28 May 2006.
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2020, May 29	M.P.O. Cavalca, V.M. Gomes, D.M. Sanchez, 2020, <i>European Physical Journal - Special Topics</i>, 229, 1557, “Mid-range natural orbits around the triple asteroid 2001 SN263.” See: https://ui.adsabs.harvard.edu/abs/2020EPJST.229.1557C/abstract
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	mitigate that threat?” - J.G. Bauer, M. Holman, M. Payne, et al., 2020, “The Planetary Science Data System’s Small Bodies Node update and the MPC Database Beta Distribution.” See: https://www.lpi.usra.edu/sbag/meetings/jun2020/presentations/sbn_MPC_Update20Bx.pdf
2020, Jun 1-3	American Astronomical Society 236th Meeting, ~~Madison (WI, USA)~~, 1 – 3 June 2020, held virtual. See: https://aas.org/meetings/aas236
2020, Jun 4	ESA NEOCC Newsletter. June 2020. See: http://neo.ssa.esa.int/newsletters [June 2020]
2020, Jun 5	Apollo NEA 2020 LD ($H = 22.4$ mag, $D \approx 120$ m) passed Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.80 LD. [2020-46] See: 2020 LD – S2P , 2020 LD - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/ See also: https://watchers.news/2020/06/09/asteroid-2002-ld/ https://theskylive.com/2020ld-info http://neo.ssa.esa.int/newsletters [July 2020] https://en.wikipedia.org/wiki/2020_LD
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2020, Jun 9	J.L. Molaro, K.J. Walsh, E.R. Jawin, et al., 2020, <i>Nature Communications</i> , 11, 2913, “In situ evidence of thermally induced rock breakdown widespread on Bennu 's surface.” See: https://ui.adsabs.harvard.edu/abs/2020NatCo..11.2913M/abstract
2020, Jun 9	D. Seligman, G. Laughlin, 2020, <i>Astrophysical Journal Letters</i> , 896, L8, “Evidence that 1I/2017 U1 (Oumuamua) was composed of molecular hydrogen ice.” See: https://ui.adsabs.harvard.edu/abs/2020ApJ...896L...8S/abstract
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2020, Jun 12	W.F. Bottke, D. Vokrouhlický, R.-L. Ballouz, et al., 2020, <i>Astronomical Journal</i> , 160, 14, “Interpreting the cratering histories of Bennu , Ryugu , and other spacecraft-explored asteroids.” See: https://ui.adsabs.harvard.edu/abs/2020AJ....160...14B/abstract
2020, Jun 12	K. Yamamoto, T. Otsubo, K. Matsumoto, et al., 2020, <i>Earth, Planets and Space</i> , 72, 85, “Dynamic precise orbit determination of Hayabusa2 using laser altimeter (LIDAR) and image tracking data sets.” See: https://ui.adsabs.harvard.edu/abs/2020EP%26S...72...85Y/abstract
2020, Jun 13, 04:45	Apollo NEA 2020 ML2 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.93 LD. Minimum miss distance 0.92 LD. [2020-47] Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/ See: 2020 ML2 – S2P , 2020 ML2 – JPL
2020, Jun 13, 21:36	Amor NEA 2020 KB3 ($H = 24.4$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 3.14 LD. Minimum miss distance 3.14 LD. See: 2020 KB3 – S2P , 2020 KB3 – JPL See also: http://neo.ssa.esa.int/newsletters [June 2020]
2020, Jun 14	Apollo NEA 2017 MF7 ($H = 26.1$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 3.61 LD. Minimum miss distance 0.91 LD.

	See: 2017 MF7 - SSA , 2017 MF7 - JPL
2020, Jun 14-19	Asteroids, Comets, Meteors Conference 2020 , Flagstaff (AZ, USA), ~~14-19 June 2020~~ . Rescheduled for: 20-25 June 2021 . See: https://www.hou.usra.edu/meetings/acm2021/
2020, Jun 15	K.H. Joy, R. Tartèse, S. Messenger, et al., 2020, <i>Earth and Planetary Science Letters</i> , 540, 116265, “The isotopic composition of volatiles in the unique Bench Crater carbonaceous chondrite impactor found in the Apollo 12 regolith.” See: https://ui.adsabs.harvard.edu/abs/2020E%26PSL.54016265J/abstract
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2020, Jun 18	P. Matlovič, J. Tóth, 2020, First Online 18 June 2020, in: P. Kabáth, D. Jones, M. Skarka (eds.), <i>Reviews in frontiers of modern astrophysics</i> (Springer: Cham), “Meteors: light from comets and asteroids.” See: https://ui.adsabs.harvard.edu/abs/2020rfma.book...23M/abstract
2020, Jun 19	D. Jewitt, Y. Kim, M. Mutchler, et al., 2020, <i>Astrophysical Journal Letters</i> , 896, L39, “Outburst and splitting of interstellar comet 2I/Borisov .” See: https://ui.adsabs.harvard.edu/abs/2020ApJ...896L..39J/abstract
2020, Jun 19	S. Kohler, 2020, <i>AAS Nova Highlight</i> , 19 Jun 2020, id.6694, “Exploring links between nearby asteroids.” See: https://ui.adsabs.harvard.edu/abs/2020nova.pres.6694K/abstract
2020, Jun 23	K.W. Smith, S.J. Smartt, D.R. Young, 2020, <i>Publications of the Astronomical Society of the Pacific</i> , 132, 085002, “Design and operation of the ATLAS (Asteroid Terrestrial impact Last Alert System) Transient Science Server .” See: https://ui.adsabs.harvard.edu/abs/2020PASP..132h5002S/abstract
2020, Jun 23	G. Tancredi, L. Lindberg Christensen, 2020, <i>IAU Press Release</i> , IAU2007, “IAU approves name of target of first NASA and ESA

	planetary defence missions --- Asteroid Didymos' moon receives its new name [Dimorphos] just over a year before deflection mission launch.” On 22 July 2021 NASA will launch the Double Asteroid Redirection Test (DART) mission. This demonstration of asteroid deflection technology will target the smaller body in the binary asteroid Didymos, and will be followed in 2024 by the ESA space probe Hera. In recognition of the asteroid's moon significance in these pioneering missions, it has been given an official name by the International Astronomical Union: Dimorphos. DART is scheduled to reach Dimorphos in 2022, deliberately colliding with it and creating a kinetic impact to alter the satellite's trajectory. The ESA space probe Hera will be launched in 2024, and is scheduled to arrive at Dimorphos in 2027, where it will perform a close-up survey to assess the effects of the DART impact on the satellite's form and orbit. See: https://www.iau.org/news/pressreleases/detail/iau2007/?lang See also: https://www.nasa.gov/planetarydefense/dart https://www.esa.int/Safety_Security/Hera https://en.wikipedia.org/wiki/65803_Didymos https://en.wikipedia.org/wiki/Dimorphos
2020, Jun 24	Apollo NEA 441987 (2010 NY65, H = 21.4 mag, D ≈ 228 m, PHA) passed Earth at a nominal miss distance of 9.78 LD. Minimum miss distance 9.78 LD. See: 2010 NY65- SSA , 2010 NY65 - JPL See also: 24 Jun 2017, 24 Jun 2018, 24 Jun 2019, 25 Jun 2181.
2020, Jun 30	Asteroid Day 2020. See: http://www.asteroidday.org/ https://content.govdelivery.com/accounts/EUESA/bulletins/29349c0 https://en.wikipedia.org/wiki/Asteroid_Day https://www.esa.int/Safety_Security/An_Agency_for_asteroids
2020, Jun 30	ESA NEOCC Newsletter. July 2020. See: http://neo.ssa.esa.int/newsletters [July 2020] http://neo.ssa.esa.int/neocc-riddles
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	rotator.” See: https://academic.oup.com/mnras/article-abstract/495/4/3990/5841535
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2020, Jul 2	Anon., 2020, <i>ESA Science & Exploration</i> , “Flight over Korolev Crater on Mars.” See: https://www.esa.int/ESA_Multimedia/Videos/2020/07/Flight_over_Korolev_Crater_on_Mars
2020, Jul 3	I.A. Belov, S.A. Bel’kov, A.Yu. Voronin, et al., 2020, <i>Journal of Experimental and Theoretical Physics</i> , 130, 783, “Laser simulations of the destructive impact of nuclear explosions on icy and iron asteroids.” See: https://ui.adsabs.harvard.edu/abs/2020JETP..130..783B/abstract
2020, Jul 3	N. Redd, 2020, <i>Science</i> , 369, 17, “Rock [Vatiras] seen inside Venus 's orbit could solve puzzle.” See: https://ui.adsabs.harvard.edu/abs/2020Sci...369...17R/abstract
2020, Jul 5	Apollo NEA 2020 NB ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.46 LD. Minimum miss distance 0.46 LD. [2020-48] See: 2020 NB – S2P , 2020 NB – JPL Discovery station: Palomar Mountain—ZTF See: http://iawn.net/ See also : 6 Jul 2199 .
2020, Jul 8	C. Potiszil, R. Tanaka, K. Kobayashi, et al., 2020, <i>Astrobiology</i> , 20,

	916, “The albedo of Ryugu : evidence for a high organic abundance, as inferred from the Hayabusa2 touchdown maneuver.” See: https://ui.adsabs.harvard.edu/abs/2020AsBio..20..916P/abstract
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2020, Jul 14	Amor NEA 2009 OS5 ($H = 24.4$ mag, $D \approx 50$ m) passed Earth at a nominal miss distance of 17.8 LD. Minimum miss distance 14.5 LD. This NEA was (in 2010) a potential target for a NASA manned mission, with launch date 11 March 2020 and 170 day mission duration. See: 2009 OS5 - SSA , 2009 OS5 - JPL See also: http://www.nasa.gov/pdf/474223main_Johnson_ExploreNOW.pdf
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2020, Jul 21	C.R. Walton, I. Baziotis, A. Černok, et al., 2020, e-print <i>arXiv:2007.11137</i> , “Formation and deformation of phosphorus-olivine-assemblages in the Chelyabinsk chondrite .” See: https://ui.adsabs.harvard.edu/abs/2020arXiv200711137W/abstract

2020, Jul 21	Apollo NEA 2002 BF25 ($H = 22.2$ mag, $D \approx 152$ m) passed Earth at a nominal miss distance of 9.39 LD. Minimum miss distance 9.39 LD. See: 2002 BF25 - SSA , 2002 BF25 - JPL See also: 20 Jul 1971.
2020, Jul 22	V.V. Makarov, A. Goldin, D. Veras, 2020, <i>Astrophysical Journal</i>, in press, e-print arXiv:2007.11487, “Gyr-timescale destruction of high-eccentricity asteroids by spin and why 2006 HY51 has been spared.” See: https://ui.adsabs.harvard.edu/abs/2020arXiv200711487M/abstract See also: 4 May 1939, 15 May 1985.
2020, Jul 23	T.-S. Yeh, B. Li, C.-K. Chang, et al., 2020, <i>Astronomical Journal</i>, 160, 73, “The asteroid rotation period survey using the China Near-Earth Object Survey Telescope (CNEOST).” See: https://ui.adsabs.harvard.edu/abs/2020AJ....160...73Y/abstract
2020, Jul 24	C. Maurel, F.J. Bryson, R.J. Lyons, et al., <i>Science Advances</i>, 6, eaba1303, “Meteorite evidence for partial differentiation and protracted accretion of planetesimals.” See: https://advances.sciencemag.org/content/6/30/eaba1303 See also: http://news.mit.edu/2020/origin-rare-meteorites-0724
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2020, Jul 28	Apollo NEA 2020 OY4 ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.108 LD. Minimum miss distance 0.108 LD. [2020-49] See: 2020 OY4 – S2P , 2020 OY4 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 28 Jul 1989. See also: http://neo.ssa.esa.int/newsletters [27 July 2020] https://neo.ssa.esa.int/documents/20126/419169/Newsletter+August+2020.pdf/f1041e17-ac93-217f-7e3b-48a9939564d8?version=1.0&t=1596618742905&preview=true https://twitter.com/esaoperations/status/1288042510607159302

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2020, Jul 31	M.-T. Hui, Q.-Z. Ye, D. Föhring, et al., 2020, <i>Astronomical Journal</i> , 160, 92, “Physical characterisation of interstellar comet 2I/2019 Q4 (Borisov) .” See: https://ui.adsabs.harvard.edu/abs/2020AJ....160...92H/abstract
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	Discovery station: Pan-STARS 1, Haleakala See: http://iawn.net/
2020, Aug 20, 23:5	Apollo NEA 2020 QY2 ($H = 31.2$ mag, $D \approx 2$ m) passed Earth at a nominal miss distance of 0.17 LD. Minimum miss distance 0.17 LD. [2020-57] See: 2020 QY2 – S2P , 2020 QY2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Aug 21	Apollo NEA 2020 QN4 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.71 LD. Minimum miss distance 0.71 LD. [2020-58] See: 2020 QN4 – S2P , 2020 QN4 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/ See also: 16 Feb 2006, 21 Feb 2050.
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2020, Sep 10, 11:33	Apollo NEA 2020 RG10 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.35 LD. Minimum miss distance 0.35 LD. [2020-62] See: 2020 RG10 – S2P , 2020 RG10 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, Sep 10, 21:04	Amor NEA 2020 QU6 ($H = 18.2$ mag, $D \approx 800$ m) passed Earth at a nominal miss distance of 104.60 LD. Minimum miss distance 104.60 LD. See: 2020 QU6 – S2P , 2020 QU6 - JPL Discovery station: Observatorio Campo dos Amarais. Observer L.S. Amaral. See also: https://skyandtelescope.org/astronomy-news/amateur-astronomer-finds-kilometer-size-asteroid/
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2020, Sep 14, 06:49	Aten NEA 2020 RF3 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.24 LD. Minimum miss distance 0.24 LD. [2020-64] See: 2020 RF3 – S2P , 2020 RF3 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 14 Sep 1961, 15 Sep 2070.
2020, Sep 14, 20:33	Aten → Apollo NEA 2020 RD4 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.27 LD. [2020-65] See: 2020 RD4 – S2P , 2020 RD4 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 15 Sep 2002, 15 Sep 2079.
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2020, Sep 15	Y. Shimaki, H. Senshu, N. Sakatani, et al., 2020, <i>Icarus</i>, 348, 113835, “Thermophysical properties of the surface of asteroid 162173 Ryugu: nfrared observations and thermal inertia mapping.” See: https://ui.adsabs.harvard.edu/abs/2020Icar..34813835S/abstract
2020, Sep 16	Anon., 2020, <i>Resource.ly</i>, 16 September 2020, “Drilling for gold reveals massive asteroid hit on WA outback.” See: http://resourc.ly/index.php/2020/09/16/drilling-for-gold-reveals-massive-asteroid-hit-on-wa-outback/ See also: https://www.space.com/meteorite-crater-australia-outback.html
2020, Sep 17	P. Pokorný, M.J. Kuchner, S.S. Sheppard, 2020, <i>Planetary Science Journal</i>, 1, 47, “A deep search for stable Venus co-orbital asteroids: limits on the population.”

	See: https://ui.adsabs.harvard.edu/abs/2020PSJ.....1...47P/abstract
2020, Sep 17	Apollo NEA 2020 RZ6 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.88 LD. [2020-66] See: 2020 RZ6 – S2P , 2020 RZ6 – JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2020, Sep 18	Apollo NEA 2020 SO3 ($H = 27.2$ mag, $D \approx 13$ m) passed Earth at a nominal miss distance of 1.03 LD. Minimum miss distance 1.03 LD. See: 2020 SO3 – S2P , 2020 SO3 - JPL
2020, Sep 19	Apollo NEA 2020 SZ2 ($H = 29.4$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.95 LD. Minimum miss distance 0.95 LD. [2020-67] See: 2020 SZ2 – S2P , 2020 SZ2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Sep 20	A. Siraj, A. Loeb, 2020, e-print <i>arXiv:2009.09512</i> , “Transfer of life between Earth and Venus with planet-grazing asteroids.” See: https://ui.adsabs.harvard.edu/abs/2020arXiv200909512S/abstract See also: http://astrobiology.com/2020/09/transfer-of-life-between-earth-and-venus-with-planet-grazing-asteroids.html https://www.space.com/venus-life-earth-grazing-asteroid
2020, Sep 21	M.C. De Sanctis, 2021, <i>Nature Astronomy</i> , 5, 9, “Asteroid smashing, mixing and forming.” See: https://ui.adsabs.harvard.edu/abs/2021NatAs...5....9D/abstract
2020, Sep 21	D.N. DellaGiustina, H.H. Kaplan, [...] D.S. Lauretta, 2020, <i>Nature Astronomy</i> , 5, 31, “Exogenic basalt [from Vesta] on asteroid (101955) Bennu .” See: https://ui.adsabs.harvard.edu/abs/2021NatAs...5...31D/abstract See also: https://www.nasa.gov/feature/goddard/2020/bennu-vesta-meteorites https://www.space.com/asteroid-bennu-has-pieces-of-vesta-osiris-rex https://asteroidday.org/news-updates/are-rocks-from-asteroid-vesta-hitch-hiking-through-space-on-asteroid-bennu/
2020, Sep 21	E. Tatsumi, C. Sugimoto, L. Riu, et al., 2020, <i>Nature Astronomy</i> , 5, 39, “Collisional history of Ryugu ’s parent body from bright surface boulders.” See: https://ui.adsabs.harvard.edu/abs/2021NatAs...5...39T/abstract See also:

	https://www.space.com/asteroid-ryugu-bright-rocks-violent-past
2020, Sep 21 – Oct	<i>Europlanet Science Congress 2020</i>, Granada (Spain), 27 September – 2 October 2020. Rescheduled for a virtual meeting, 21 September – 9 October 2020. EPSC Session SB11: Physical properties of small bodies: observations and techniques. See: https://www.europlanet-society.org/epsc-2020-in-the-heart-of-granada/ https://www.epsc2020.eu/
2020, Sep 23	K. Beatty, 2020, <i>Sky & Telescope</i>, 23 September 2020, “Is Phaethon a “rock comet”?” See: https://skyandtelescope.org/astronomy-news/is-phaethon-a-rock-comet/
2020, Sep 23	<i>11th International Asteroid Warning Network Steering Committee Meeting</i>, Cambridge (MA, USA), 23 September 2020. Among the agenda items: - D. Koschny, 2020, “ESA Planetary Defence Office”. Update. - K. Fast, 2020, “NASA Planetary Coordination Office.” Update. - G. Valsecchi, 2020, “Italian Institute for Astrophysics (INAF).” Update. - P. Michel, 2020, “Observatoire de la Côte d’Azur (OCA).” Update. - H.-K. Moon, 2020, “Korea Astronomy and Space Science Institute (KASI).” Update. - S. Camacho, 2020, “Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE).” Update. - G. Bauer, 2020, “IAWN.net.” Update - D. Daou, 2020, “International Year of Planetary Defense (2029?).” Concept. - G. Bauer, 2020, “Minor Planet Center.” Update. - P. Chodas, NASA JPL, 2020, “Recent modifications to computations of Palermo Scale.” - R. Kofler, UNOOSA, 2020, “Planetary Defense Conference 2021.” See: http://iawn.net/meetings.shtml http://iawn.net/meetings/11-steering-cmte.shtml http://iawn.net/documents/20200923_11th_virtual/11th_IAWN_Mtg_Summary.pdf
2020, Sep 23	Apollo NEA 2020 SG6 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.58 LD. Minimum miss distance 0.58 LD. [2020-68] See: 2020 SG6 – S2P , 2020 SG6 - JPL Discovery station: Mt. Lemmon Survey

	See: http://iawn.net/
2020, Sep 24	E. Morton, 2020, 24 September 2020, Asteroidmission.org, “ OSIRIS-REx begins its countdown to TAG.” See: https://www.asteroidmission.org/?latest-news=osiris-rex-begins-its-countdown-to-tag
2020, Sep 24	15th Meeting Space Mission Planning Advisory Group (SMPAG) , 24 September 2020, Cambridge (MA, USA). Virtual Meeting. See: https://www.cosmos.esa.int/web/smpag/ https://www.cosmos.esa.int/web/smpag/meeting_15_-_sep_2020 Presentations: - A. Harris, A. Falke, S. Ulamec, et al., 2020, “Current NEO-related activities in Germany.” See: https://www.cosmos.esa.int/documents/336356/336472/NEO-related_activities_in_Germany_-_Harris_2020-09-24+%281%29.pdf/ - H.-K. Moon, Y.-J. Choi, M.-J. Kim, et al., 2020, “ Apophis rendezvous mission for 2029: draft plan.” See: https://www.cosmos.esa.int/documents/336356/336472/Apophis_rendevous_-_Moon_2020-09-24+%281%29.pdf/ - I. Carnelli, 2020, “ Hera mission.” See: https://www.cosmos.esa.int/documents/336356/336472/HERA_mission_-_Carnelli_2020-09-24.pdf/ - I. Marboe, C. Steinkogler, 2020, “Publication of the SMPAG Legal Working Group (LWG) report.” See: https://www.cosmos.esa.int/documents/336356/336472/Publication_of_the_LWG_Report_v2_-_Marboe_2020-09-24.pdf/ - A.J. Haddaji, 2020, “ SMPAG ad-hoc Legal Working Group moving forward.” See: https://www.cosmos.esa.int/documents/336356/336472/LWG_ways_forward_2020-09-24.pdf/
2020, Sep 24, 11:13	Aten → Apollo NEA 2020 SW ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.0730 LD (= 4.41 R_{Earth} = 28,079 km from the geocenter). Minimum miss distance 0.0730 LD (= 4.41 R_{Earth} = 28,072 km from the geocenter). [2020-69] See: 2020 SW – S2P , 2020 SW - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: http://neo.ssa.esa.int/ [ESA-S2P-PD-CAFS-0003_1_0_2020SW_2020-09-22.pdf] https://www.jpl.nasa.gov/news/news.php?feature=7752 https://en.wikipedia.org/wiki/List_of_asteroid_close_approaches_to_Earth_in_2020
2020, Sep 24, 12:47	Apollo NEA 2020 SN5 ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.53 LD. Minimum miss distance 0.52 LD.

	[2020-70] See: 2020 SN5 – S2P , 2020 SN5 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2020, Sep 26	Apollo NEA 2020 SQ4 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.91 LD. [2020-71] See: 2020 SQ4 – S2P , 2020 SQ4 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Sep 29	Apollo NEA 2020 PM7 ($H = 22.4$ mag, $D \approx 120$ m) passed Earth at a nominal miss distance of 7.47 LD. Minimum miss distance 7.47 LD. See: 2020 PM7 – S2P , 2020 PM7 - JPL
2020, Oct	H.F. Agrusa, D.C. Richardson, A.B. Davis, et al., 2020, <i>Icarus</i>, 349, 113849, “A benchmarking and sensitivity study of the full two-body gravitational dynamics of the DART mission target, binary asteroid 65803 Didymos.” See: https://ui.adsabs.harvard.edu/abs/2020Icar..34913849A/abstract
2020, Oct	B.T. Bolin, C.M. Lisse, 2020, <i>Monthly Notices of the Royal Astronomical Society</i>, 497, 4031, “Constraints on the spin-pole orientation, jet morphology, and rotation of interstellar comet 2I/Borisov with deep HST imaging.” See: https://ui.adsabs.harvard.edu/abs/2020MNRAS.497.4031B/abstract
2020, Oct	T. Saiki, Y. Takei, Y. Mimasu, et al., 2020, <i>Acta Astronautica</i>, 175, 362, “Hayabusa2’s kinetic impact experiment: operational planning and results.” See: https://ui.adsabs.harvard.edu/abs/2020AcAau.175..362S/abstract
2020, Oct	O. Vaduvescu, L. Curelaru, M. Popescu, et al., 2020, <i>Astronomy & Astrophysics</i>, 642, 35, “Dozens of virtual impactor orbits eliminated by the EURONEAR VIMP DECam data mining project.” See: https://ui.adsabs.harvard.edu/abs/2020A%26A...642A..35V/abstract
2020, Oct 1	M. Froncisz, P. Brown, R.J. Weryk, 2020, <i>Planetary and Space Science</i>, 190, 104980, “Possible interstellar meteoroids detected by the Canadian Meteor Orbit Radar (CMOR).” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..19004980F/abstract
2020, Oct 1	A.W. Harris, L. Drube, 2020, <i>Astrophysical Journal</i>, 901, 140, “Asteroid thermal inertia estimates from remote infrared observations: the effects of surface roughness and rotation rate.”

	See: https://ui.adsabs.harvard.edu/abs/2020ApJ...901..140H/abstract
2020, Oct 1	S.I. Ipatov, E.A. Feoktistova, V.V. Svetsov, 2020, <i>Solar System Research</i> , 54, 384, “Number of Near-Earth Objects and formation of lunar craters over the last billion years.” See: https://ui.adsabs.harvard.edu/abs/2020SoSyR..54..384I/abstract
2020, Oct 1	Y. Jiang, J. Schmidt, 2020, <i>Heliyon</i> , 6, E05275, “Motion of dust ejected from the surface of asteroid (101955) Bennu .” See: https://www.cell.com/heliyon/fulltext/S2405-8440(20)32118-6
2020, Oct 1	S.-Y. Liao, M.H. Huyskens, Q.-Z. Yin, B. Schmitz, 2020, <i>Earth and Planetary Science Letters</i> , 547, 116442, “Absolute dating of the L-chondrite parent body breakup with high-precision U-Pb zircon geochronology from Ordovician limestone.” See: https://ui.adsabs.harvard.edu/abs/2020E%26PSL.54716442L/abstract
2020, Oct 1	Apollo NEA 2020 TA ($H = 25.5$ mag, $D \approx 28$ m) passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.57 LD. [2020-72] See: 2020 TA – S2P , 2020 TA - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2020, Oct 4-7	<i>European Astronomical Society Annual Meeting EAS 2020 (EWASS)</i> , Leiden (The Netherlands), 4 - 7 Oct 2020, a virtual meeting . See: https://eas.unige.ch/EAS2020/
2020, Oct 5	ESA NEOCC Newsletter . October 2020. See: http://neo.ssa.esa.int/newsletters [October 2020] http://neo.ssa.esa.int/neocc-riddles
2020, Oct 6	S. Jaworski, J. Kindracki, 2020, <i>Journal of Spacecraft and Rockets</i> , 57, 1232, “Feasibility of synchronized CubeSat missions from low Earth orbit to Near-Earth Asteroids.” See: https://ui.adsabs.harvard.edu/abs/2020JSpRo..57.1232J/abstract
2020, Oct 8	B. Enos, 2020, <i>NASA.gov/feature</i> , 8 October 2020, “NASA’s OSIRIS-REx unlocks more secrets from asteroid Bennu .” See: https://www.nasa.gov/feature/goddard/2002/osiris-rex-unlocks-more-secrets-from-asteroid-bennu
2020, Oct 8	B. Rozitis, A.J. Ryan, J.P. Emery, et al., 2020, <i>Science Advances</i> , 6, eabc3699, “Asteroid (101955) Bennu ’s weak boulders and thermally anomalous equator.” See: https://advances.sciencemag.org/content/6/41/eabc3699

	See also: https://www.sciencemag.org/news/2020/10/nasa-mission-about-capture-carbon-rich-dust-former-water-world
2020, Oct 8	D.J. Scheeres, A.S. French, P. Tricarico, et al., 2020, <i>Science Advances</i> , 6, eabc3350, “Heterogeneous mass distribution of the rubble-pile asteroid (101955) Bennu .” See: https://advances.sciencemag.org/content/6/41/eabc3350 See also: https://www.sciencemag.org/news/2020/10/nasa-mission-about-capture-carbon-rich-dust-former-water-world
2020, Oct 8	D.E. Trilling, C. Lisse, D.P. Cruikshank, et al., 2020, <i>Nature Astronomy</i> , 4, 940, “ Spitzer ’s Solar System studies of asteroids, planets and the zodiacal cloud.” See: https://ui.adsabs.harvard.edu/abs/2020NatAs...4..940T/abstract
2020, Oct 8	P. Voosen, 2020, <i>Science</i> , 8 October 2020, “A NASA mission is about to capture carbon-rich dust from a former water world.” See: https://www.sciencemag.org/news/2020/10/nasa-mission-about-capture-carbon-rich-dust-former-water-world
2020, Oct 8	Apollo NEA 2020 TP1 ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 1.006 LD. Minimum miss distance 1.004 LD. See: 2020 TP1 – S2P , 2020 TP1 - JPL
2020, Oct 9	P. Voosen, 2020, <i>Science</i> , 370, 158, “NASA mission set to sample carbon-rich asteroid.” See: https://science.sciencemag.org/content/370/6513/158 See also: https://www.sciencemag.org/news/2020/10/nasa-mission-about-capture-carbon-rich-dust-former-water-world
2020, Oct 9	Apollo NEA 2020 TE5 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.15 LD. Minimum miss distance 0.15 LD. [2020-73] See: 2020 TE5 – S2P , 2020 TE5 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2020, Oct 12	Aten NEA 2020 TS1 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.66 LD. Minimum miss distance 0.66 LD. [2020-74] See: 2020 TS1 – S2P , 2020 TS1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/

2020, Oct 13	Apollo NEA 2020 TD7 ($H = 26.8$ mag, $D \approx 15$ m) passed Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.88 LD. [2020-75] See: 2020 TD7 – S2P , 2020 TD7 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, Oct 14	Live Tonight! 14 October 2020. The ASP presents a special virtual event: "Asteroid Hunters", a virtual panel discussion with filmmakers and Planetary Defense experts, including writer/producer Phil Groves, planetary scientist Dr. Donald Yeomans, and Planetary Defense experts. See: https://myemail.constantcontact.com/LIVE-TONIGHT--Open-to-All---ASP-Special-Event--Oct--14----Asteroid-Hunters---A-Panel-Discussion-with-Documentary-Filmmaker---Sci.html https://www.youtube.com/watch?v=uW-P35CNwBI&feature=emb_logo
2020, Oct 14, 07:05	Atira NEA 2020 AV2 ($H = 16.4$ mag, $D \approx 1900$ m) passed Earth at a nominal miss distance of 136 LD (= 0.35 AU). Minimum miss distance 136 LD (= 0.35 AU). See: 2020 AV2 – S2P , 2020 AV2 – JPL See also: 13 Jan 2020. Re: - S. Greenstreet, 2020, <i>Monthly Notices of the Royal Astronomical Society: Letters</i>, 493, L129, “Orbital dynamics of 2020 AV2: the first Vatira asteroid.” See: https://ui.adsabs.harvard.edu/abs/2020MNRAS.tmpL..23G/abstract It is the first asteroid discovered to have an orbit entirely within Venus's orbit, and is thus the first and only known member of the intra-Venusian Vatira population of Atira-class asteroids. 2020 AV2 has the smallest known aphelion and second-smallest known semi-major axis among all asteroids. See also: https://en.wikipedia.org/wiki/2020_AV2
2020, Oct 14, 16:00	Apollo/Aten (?) NEA 2020 TK7 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.20 LD. Minimum miss distance 0.20 LD. [2020-76] See: 2020 TK7 – S2P , 2020 TK7 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 14 Oct 2091.
2020, Oct 15	H.A.R. Devillepoix, M. Cupák, P.A. Bland, et al., 2020, <i>Planetary and Space Science</i>, 191, 105036, “A Global Fireball Observatory.”

	See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..19105036D/abstract
2020, Oct 15	D. Harries, A. Bischoff, 2020, <i>Earth and Planetary Science Letters</i> , 548, 116506, “Petrological evidence for the existence and disruption of a 500 km-sized differentiated planetesimal of enstatite-chondritic parentage.” See: https://ui.adsabs.harvard.edu/abs/2020E%26PSL..54816506H/abstract
2020, Oct 15	S. Kikuchi, S.-i. Watanabe, [...] Y. Tsuda, 2020, <i>Space Science Reviews</i> , 216, 116, “ Hayabusa2 landing site selection: surface topography of Ryugu and touchdown safety.” See: https://ui.adsabs.harvard.edu/abs/2020SSRv..216..116K/abstract
2020, Oct 15	K. Ohtsuka, T. Ito, D. Kinoshita, et al., 2020, <i>Planetary and Space Science</i> , 191, 104940, “Full rotationally phase-resolved visible reflectance spectroscopy of 3200 Phaethon .” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..19104940O/abstract
2020, Oct 15	Apollo NEA 2020 UE ($H = 25.6$ mag, $D \approx 27$ m) passed Earth at a nominal miss distance of 0.71 LD. Minimum miss distance 0.71 LD. [2020-77] See: 2020 UE – S2P , 2020 UE - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 15 Oct 2034 .
2020, Oct 16	A. Witze, 2020, <i>Nature</i> , 586, 484, “NASA ‘fist bumps’ an asteroid to reveal Solar System’s secrets.” See: https://ui.adsabs.harvard.edu/abs/2020Natur.586..484W/abstract
2020, Oct 16	Apollo NEA 2020 UU1 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 1.07 LD. Minimum miss distance 1.06 LD. See: 2020 UU1 – S2P , 2020 UU1 - JPL
2020, Oct 17	Apollo NEA 2020 TG6 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.36 LD. Minimum miss distance 0.36 LD. [2020-78] See: 2020 TG6 – S2P , 2020 TG6 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Oct 18	Apollo NEA 2020 TE6 ($H = 27.6$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.60 LD. Minimum miss distance 0.60 LD. [2020-79] See: 2020 TE6 – S2P , 2020 TE6 - JPL Discovery station: Pan-STARRS 1, Haleakala

	See: http://iawn.net/
2020, Oct 19	B. Cheng, Y. Yu, E. Asphaug, P. Michel, et al., 2020, <i>Nature Astronomy</i> , 5, 134, “Reconstructing the formation history of top-shaped asteroids from the surface boulder distribution.” See: https://ui.adsabs.harvard.edu/abs/2021NatAs...5..134C/abstract
2020, Oct 19, 06:56	Apollo NEA 2020 UX ($H = 31.1\text{mag}$, $D \approx 2.1\text{ m}$) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2020-80] See: 2020 UX – S2P , 2020 UX - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: https://www.space.com/2-asteroids-earth-flyby-same-day-october-2020
2020, Oct 19, 19:24	Apollo NEA 2020 TF6 ($H = 27.4\text{ mag}$, $D \approx 12\text{ m}$) passed Earth at a nominal miss distance of 0.40 LD. Minimum miss distance 0.40 LD. [2020-81] See: 2020 TF6 – S2P , 2020 TF6 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: https://www.space.com/2-asteroids-earth-flyby-same-day-october-2020
2020, Oct 20	The NASA OSIRIS-REx mission prepares for touchdown to asteroid Bennu this October 20th with a final rehearsal earlier this month. The spacecraft, which has been circling Bennu since December 2018 mapping its surface, will be using Touch-and-Go sequence (TAG) to pick up samples of the asteroid to return home. See: https://us9.campaign-archive.com/?u=0e9c23265f31e0f37201d19b6&id=98145b6d5a https://www.fox10phoenix.com/video/842725 See also: https://www.sciencemag.org/news/2020/10/nasa-mission-about-capture-carbon-rich-dust-former-water-world https://www.space.com/nasa-osiris-rex-asteroid-sampling-360-video https://www.nasa.gov/press-release/nasa-s-osiris-rex-spacecraft-successfully-touches-asteroid http://www.nasa.gov/osiris-rex http://science.nasa.gov/missions/osiris-rex/ https://www.nasa.gov/press-release/nasa-invites-public-media-to-watch-asteroid-mission-begin-return-to-earth https://en.wikipedia.org/wiki/OSIRIS-REx
2020, Oct 20	G. Hautaluoma, J. Handal, N. Neal Jones, E. Morton, 2020, <i>NASA.gov/press-release</i> , 20 October 2020, “NASA’s OSIRIS-REx

	spacecraft successfully touches asteroid.” See: https://www.nasa.gov/press-release/nasa-s-osiris-rex-spacecraft-successfully-touches-asteroid See also: http://www.nasa.gov/osiris-rex http://science.nasa.gov/missions/osiris-rex/ https://en.wikipedia.org/wiki/OSIRIS-REx
2020, Oct 21	B. Enos, N. Neal Jones, E. Morton, 2020, <i>NASA.gov/feature/goddard</i>, 22 October 2020, ”OSIRIS-REx TAGs surface of asteroid Bennu.” See: https://www.nasa.gov/feature/goddard/2020/osiris-rex-tags-surface-of-asteroid-bennu/ See also: https://www.space.com/nasa-osiris-rex-asteroid-bennu-sampling-results https://www.nasa.gov/press-release/nasa-s-osiris-rex-spacecraft-collects-significant-amount-of-asteroid https://asteroidday.org/news-updates/nasas-osiris-rex-mission-successfully-makes-contact-with-asteroid-bennu/
2020, Oct 21, 02:24	Aten NEA 2020 UA ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.12 LD. Minimum miss distance 0.12 LD. [2020-82] See: 2020 UA – S2P , 2020 UA - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 21 Oct 2047.
2020, Oct 21, 04:24	Apollo NEA 2020 UY ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2020-83] See: 2020 UY – S2P , 2020 UY - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Oct 22, 09:46	Apollo NEA 2020 UL2 ($H = 28.7$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 1.07 LD. Minimum miss distance 1.06 LD. See: 2020 UL2 – S2P , 2020 UL2 - JPL
2020, Oct 22, 15:53	Apollo NEA 2020 UO3 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2020-84] See: 2020 UO3 – S2P , 2020 UO3 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, Oct 22, 22:28	Aten/Apollo (?) NEA 2020 UF3 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.11 LD. Minimum miss distance

	0.11 LD. [2020-85] See: 2020 UF3 – S2P , 2020 UF3 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 23 Oct 2019 . [CHECK]
2020, Oct 26	G. Danger, A. Ruf, J. Maillard, et al., 2020, <i>Planetary Science Journal</i> , 1, 55, “Unprecedented molecular diversity revealed in meteoritic Insoluble Organic Matter (IOM): the Paris meteorite's case.” See: https://ui.adsabs.harvard.edu/abs/2020PSJ.....1...55D/abstract
2020, Oct 26	G. Hautaluoma, A. Johnson, N. Neal Jones, E. Morton, 2020, <i>nasa.gov/press release</i> , 26 October 2020, “NASA’s OSIRIS-REx spacecraft goes for early stow of asteroid sample.” See: https://www.nasa.gov/press-release/nasa-s-osiris-rex-spacecraft-goes-for-early-stow-of-asteroid-sample See also: https://www.space.com/osiris-rex-asteroid-sample-stowage-begins
2020, Oct 26-30	52nd Annual Meeting of the AAS Division for Planetary Sciences , 20-26 October 2020, virtual. Among the sessions: - Ground-based asteroid surveys - Asteroid hazards and Planetary Defense - Asteroid surveys in the era of LSST Plenary panel: Interstellar objects and active small bodies See: https://aas.org/meetings/dps52 See also: https://dps.aas.org/meetings/future Among the presentations: - H.F. Agrusa, K. Tsiganis, I. Gkolias, et al., 2020, <i>AAS DPS #52</i> , id. 217.04, “On the post-impact spin state of the secondary component of the Didymos-Dimorphos binary asteroid system.” See: https://ui.adsabs.harvard.edu/abs/2020DPS....5221704A/abstract - B. Allen, J. Hong, D. Hoak, et al., 2020, <i>AAS DPS #52</i> , id. 405.06, “Observation performance prediction and evaluation for the Regolith X-ray Imaging Spectrometer (REXIS) through simulation.” See: https://ui.adsabs.harvard.edu/abs/2020DPS....5240506A/abstract - B. Aponte-Hernández, E. Rivera-Valentín, P. Taylor, 2020, <i>AAS DPS #52</i> , id. 409.06, “Revisiting the relationship between Near-Earth Asteroid radar properties and taxonomic class.” See: https://ui.adsabs.harvard.edu/abs/2020DPS....5240906A/abstract - M. Arakawa, R. Honda, Y. Yokota, et al., 2020, <i>AAS DPS #52</i> , id. 405.01, “Resurfacing processes on asteroid (162173) Ryugu caused by an artificial impact of Hayabusa2's Small Carry-on Impactor .” See: https://ui.adsabs.harvard.edu/abs/2020DPS....5240501A/abstract

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2020, Nov 2, 11:33	Apollo NEA 2018 VP1 ($H = 30.9$ mag, $D \approx 2.3$ m) passed Earth at a nominal miss distance of 1.09 LD. Minimum miss distance 0.015 LD (= 0.92 R_{Earth} from the geocenter). See: 2018 VP1 - SSA , 2018 VP1 - JPL See also: http://iawn.net/ See also: 2 Nov 2018, https://b612foundation.org/good-news-2018-vp1-hitting-earth-is-nothing-to-worry-about/ http://neo.ssa.esa.int/newsletters [November 2020] https://en.wikipedia.org/wiki/2018_VP1
2020, Nov 4-6	<i>Apophis T–9 Years: Knowledge Opportunities for the Science of Planetary Defense workshop</i>, Nice (France), 9–10 November 2020, rescheduled as a virtual event 4-6 November 2020. See: https://www.hou.usra.edu/meetings/apophis2020/ Program and abstracts: https://www.hou.usra.edu/meetings/apophis2020/program/apophis2020_program_printed.pdf Session 1: Apophis is coming! Orbit dynamics of Apophis’ close flyby. - R.P. Binzel, 2020, “Apophis T-9 and counting: setting the stage for the science of Planetary Defense.” [#2022] See: https://www.hou.usra.edu/meetings/apophis2020/pdf/2022.pdf - L.N. Johnson, 2020, “Discovery of Apophis and subsequent impact on NASA’s Planetary Defense Program.” [#2070] See: https://www.hou.usra.edu/meetings/apophis2020/pdf/2070.pdf - S.R. Chesley, D. Farnocchia, 2020, “Apophis impact hazard assessment and sensitivity to spacecraft contact.” [#2049] See: https://www.hou.usra.edu/meetings/apophis2020/pdf/2049.pdf - D.J. Scheeres, A. Meyer, A.B. Davis, 2020, “Stationkeeping about Apophis through its 2029 earth flyby.” [#2025] See: https://www.hou.usra.edu/meetings/apophis2020/pdf/2025.pdf

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2020, Nov 9	Apollo NEA 2020 VR1 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2020-88] See: 2020 VR1 – S2P , 2020 VR1 - JPL Discovery station: Tokyo-Kiso See: http://iawn.net/
2020, Nov 10	B612 Asteroid Institute , 2020 Annual Progress Report. See: https://b612foundation.org/asteroid-institute-2020-annual-progress-report/
2020, Nov 10	Hera Community Workshop , 11–13 November 2020, Nice (France). Postponed . A status update on the mission was given by videoconference on November 10. Topics: - DART status (Andy Cheng) - LICIACube status (Elisabetta Dotto) - Hera status (Ian Carnelli)

	- Hera science in the context of latest results from OSIRIS-REx and Hayabusa2 (Patrick Michel) - Hera team structure and working groups (Michael Küppers) - Juventas status (Hannah Goldberg) - Milani status (Margherita Cardì) See: https://www.cosmos.esa.int/web/hera-community-workshop/
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2020, Nov 12	I.J. O’Neill, J. Handal, 2020, <i>JPL News Feature</i>, 7783, “Earth may have captured a 1960s-era rocket booster.” See: https://www.jpl.nasa.gov/news/news.php?feature=7783
2020, Nov 13, 17:2	Apollo → Aten NEA 2020 VT4 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.01755 LD (= 1.059 R_{Earth} from the geocenter = 370 km over the Pacific Ocean). Minimum miss distance 0.01752 LD (= 1.057 R_{Earth} from the geocenter). [2020-90] See: 2020 VT4 – S2P , 2020 VT4 – JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/ Closest Earth flyby to date. See also: 17 Nov 1937. See also: https://www.syfy.com/syfywire/on-friday-a-small-asteroid-passed-just-400-km-from-earth https://www.youtube.com/watch?v=Fl5JYZMuTb8 https://en.wikipedia.org/wiki/2020_VT4
2020, Nov 13, 19:4	Apollo NEA 2020 VH5 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a

	nominal miss distance of 0.66 LD. Minimum miss distance 0.66 LD. [2020-91] See: 2020 VH5 – S2P , 2020 VH5 – JPL Discovery station: Tokyo-Kiso See: http://iawn.net/ See also: 16 Nov 2082.
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2020, Nov 19	Anon., 2020, <i>NSF News Release</i>, 20-010, 19 November 2020, “NSF begins planning for decommissioning of Arecibo Observatory’s 305-meter telescope due to safety concerns.” See: https://www.nsf.gov/news/news_summ.jsp?cntn_id=301674 https://www.nsf.gov/news/news_summ.jsp?cntn_id=301737 The Arecibo Observatory was from 1963 to 2016 the world’s largest single dish radiotelescope. The 305 m Arecibo radio telescope was during 57 year active in many fields of radio astronomy. In recent years it acted frequently as ‘radar-eye’, imaging passing asteroids. See also: https://www.space.com/arecibo-observatory-loss-for-planetary-defense-asteroids

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2020, Nov 26, 02:3	Apollo NEA 2020 WG5 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.94 LD. Minimum miss distance 0.94 LD. [2020-93] See: 2020 WG5 – S2P , 2020 WG5 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2020, Nov 26, 08:1	Apollo NEA 2020 WF5 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.52 LD. [2020-94] See: 2020 WF5 – S2P , 2020 WF5 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
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	See: https://ui.adsabs.harvard.edu/abs/2020PASA...37...49J/abstract
2020, Nov 30	Aten/Apollo NEA 2020 XC ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.32 LD. Minimum miss distance 0.31 LD. [2020-95] See: 2020 XC – S2P , 2020 XC – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 22 Dec 2003, 30 May 2013.
2020, Dec	S. Abe, T. Ogawa, K. Maeda, T. Arai, 2020, <i>Planetary and Space Science</i> , 194, 105040, “Sodium variation in Geminid meteoroids from (3200) Phaethon .” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..19405040A/abstract
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2020, Dec	P. Brown, R.J. Weryk, 2020, <i>Icarus</i> , 352, 113975, “Coordinated optical and radar measurements of low velocity meteors” See: https://ui.adsabs.harvard.edu/abs/2020Icar..35213975B/abstract
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2020, Dec	S. Fornasier, P.H. Hasselmann, J.D.P Deshapriya, et al., 2020, <i>Astronomy & Astrophysics</i> , 644, 142, “Phase reddening on asteroid Bennu from visible and near-infrared spectroscopy.” See: https://ui.adsabs.harvard.edu/abs/2020A%26A...644A.142F/abstract
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2020, Dec	M. Hirabayashi, R. Nakano, E. Tatsumi, et al., 2020, <i>Icarus</i> , 352, 113946, “Spin-driven evolution of asteroids' top-shapes at fast and

	slow spins seen from (101955) Bennu and (162173) Ryugu .” See: https://ui.adsabs.harvard.edu/abs/2020Icar..35213946H/abstract
2020, Dec	F. Hörz, A.T. Basilevsky, J.W.Head, M.J.Cintala, 2020, <i>Planetary and Space Science</i> , 194, 105105, “Erosion of lunar surface rocks by impact processes: a synthesis.” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..19405105H/abstract
2020, Dec	S. Ieva, E. Dotto, E. Mazzotta Epifani, et al., 2020, <i>Astronomy & Astrophysics</i> , 644, 23, “Extended photometric survey of near-Earth objects.” See: https://ui.adsabs.harvard.edu/abs/2020A%26A..644A..23I/abstract
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2020, Dec	C.A Sinclair, M.C Wyatt, A. Morbidelli, D. Nesvorný, 2020, <i>Monthly Notices of the Royal Astronomical Society</i>, 499, 5334, “Evolution of the Earth's atmosphere during Late Veneer accretion.” See: https://ui.adsabs.harvard.edu/abs/2020MNRAS.499.5334S/abstract
2020, Dec	M. Wesołowski, 2020, <i>Planetary and Space Science</i>, 194, 105117, “Change in the brightness of interstellar comet 2I/Borisov.” See: https://ui.adsabs.harvard.edu/abs/2020P%26SS..19405117W/abstract
2020, Dec	K. Wilhelm, B.N. Dwivedi, 2020, <i>Galaxies</i>, 8, 83, “Anomalous Sun flyby of 1I/2017 U1 (‘Oumuamua).” See: https://ui.adsabs.harvard.edu/abs/2020Galax...8...83W/abstract
2020, Dec 1, 08:47	2020 SO ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.13131 LD. Minimum miss distance 0.13130 LD. See: 2020 SO – S2P , 2020 SSO - JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/ Upper Centauri rocket booster from the 1960's. See also: 2 Feb 2021. See also: https://edition.cnn.com/2020/09/23/us/mini-moon-scen-trnd/index.html https://www.sciencealert.com/earth-might-be-about-to-get-a-temporary-minimoon-but-what-is-it https://www.space.com/earth-minimoon-2020-so-may-be-vintage-space-junk http://neo.ssa.esa.int/newsletters [October 2020] https://www.space.com/disguise-asteroid-actually-old-rocket-body https://www.jpl.nasa.gov/news/news.php?feature=7783 https://www.jpl.nasa.gov/news/news.php?feature=7795 https://www.space.com/2020-so-space-junk-asteroid-lessons https://ui.adsabs.harvard.edu/abs/2020ATel14241....1W/abstract

	https://en.wikipedia.org/wiki/2020_SO
2020, Dec 1	Apollo NEA 2020 XE ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.77 LD. Minimum miss distance 0.77 LD. [2020-96] See: 2020 XE – S2P , 2020 XE – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Dec 1-17	American Geophysical Union Fall Meeting , 1-17 December 2020, Online everywhere. See: https://www.agu.org/Fall-Meeting See also: https://www.nasa.gov/topics/earth/agu/index.html
2020, Dec 3	B. Weiner, E. Pearce, H. Krantz, et al., 2020, <i>ATel</i> #14241, “MMT/Binospec spectroscopy of near earth object 2020 SO distinguishes it from common natural asteroids.” See: https://ui.adsabs.harvard.edu/abs/2020ATel14241....1W/abstract
2020, Dec 3, 08:23	Apollo NEA 2020 XE1 ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.85 LD. Minimum miss distance 0.85 LD. [2020-97] See: 2020 XE1 – S2P , 2020 XE1 – JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 7 Dec 2143 .
2020, Dec 3, 09:00	Aten NEA 2020 XF ($H = 26.7$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.23 LD. [2020-98] See: 2020 XF – S2P , 2020 XF – JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 2 Dec 2027 .
2020, Dec 3, 10:06	Apollo NEA 2020 VZ6 ($H = 25.2$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 0.91 LD. Minimum miss distance 0.91 LD. [2020-99] See: 2020 VZ6 – S2P , 2020 VZ6 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Dec 5	ESA NEOCC Newsletter . December 2020. See: http://neo.ssa.esa.int/newsletters [December 2020] http://neo.ssa.esa.int/neocc-riddles

2020, Dec 5	Return of asteroid sample return mission Hayabusa2. 2nd asteroid sample return mission (following Hayabusa). Target: asteroid Ryugu, a C-type asteroid. Main objective: collect organic matter from the beginning of the Solar System. Launch: 3 December 2014; arrival at Ryugu: 27 June 2018; return on Earth (Woomera Test Range, Australia): 6 December 2020. See: https://www.cosmos.esa.int/documents/336356/336472/Hayabusa2_2020-02-06.pdf/ http://neo.ssa.esa.int/newsletters [August 2020] https://www.space.com/hayabusa2-asteroid-capsule-return-australia-approved.html https://www.nasaspaceflight.com/2020/12/hayabusa2-returns-to-australia/ https://www.hayabusa2.jaxa.jp/en/ https://www.hayabusa2.jaxa.jp/en/topics/20201206_fireball/ https://www.youtube.com/watch?v=9fQGsbKnH-U https://www.space.com/hayabusa2-asteroid-ryugu-samples-arrive-in-japan https://phys.org/news/2020-12-black-sand-like-asteroid-japan-probe.html https://phys.org/news/2020-12-japanese-spacecraft-gifts-asteroid-chips.html https://www.hayabusa2.jaxa.jp/en/topics/20201116_extMission/ https://subarutelescope.org/en/news/topics/2020/11/25/2914.html https://scitechdaily.com/next-target-asteroid-for-hayabusa2-photographed-by-subaru-telescope/ https://en.wikipedia.org/wiki/Hayabusa2
2020, Dec 7, 16:15	Apollo NEA 2020 XK1 ($H = 30.6$ mag, $D \approx 2.7$ m) passed Earth at a nominal miss distance of 0.0541 LD (= 3.27 R_{Earth} from the geocenter). Minimum miss distance 0.0541 LD (=3.27 R_{Earth} from the geocenter). [2020-100] See: 2020 XK1 – S2P , 2020 XK1 – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2020, Dec 7, 19:15	Apollo NEA 2020 XG2 ($H = 27.9$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.13 LD. [2020-101] See: 2020 XG2 – S2P , 2020 XG2 – JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2020, Dec 9	Anon, 2020, <i>National Space Policy United States of America</i>. On p. 24: “The Administrator of NASA, in collaboration with other appropriate agencies, Federal laboratories, and commercial partners, shall, consistent with applicable law: ... Pursue capabilities, in cooperation with other agencies, commercial, and international partners, to detect, track, catalog, and characterize near Earth objects to warn of any predicted Earth impact and to identify potentially

	resource-rich planetary objects; and Develop options, in collaboration with other agencies, and international partners, for planetary defense actions both on Earth and in space to mitigate the potential effects of a predicted near Earth object impact or trajectory.” See: https://www.whitehouse.gov/wp-content/uploads/2020/12/National-Space-Policy.pdf
2020, Dec 12	S. Aljbaae, D.M. Sanchez, A.F.B.A. Prado, et al., 2020, e-print <i>arXiv:2012.06781</i>, “First approximation for spacecraft motion relative to (99942) Apophis.” See: https://ui.adsabs.harvard.edu/abs/2020arXiv201206781A/abstract
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2020, Dec 13	H.J. Newberg, L. Swordy, T.D. Ditto, 2020, <i>Proceedings of the SPIE</i>, 11445, 114452I, “Feasibility of NEO detection with a primary objective grating telescope.” See: https://ui.adsabs.harvard.edu/abs/2020SPIE11445E..2IN/abstract
2020, Dec 13	G. Nishiyama T. Kawamura N. Namiki, et al., 2020, <i>Journal of Geophysical Research: Planets</i>, 126, e06594, “Simulation of seismic wave propagation on asteroid Ryugu induced by the impact experiment of the Hayabusa2 mission: limited mass transport by low yield strength of porous regolith.” See: https://ui.adsabs.harvard.edu/abs/2021JGRE..12606594N/abstract
2020, Dec 13	G.R. Zengilowski, C.W. McMurtry, J.L. Pipher, et al., 2020, <i>Proceedings of the SPIE</i>, 11454, 1145435, “Signal nonlinearity measurements and corrections in MWIR and LWIR HgCdTe H2RG arrays for NEO Surveyor.” See: https://ui.adsabs.harvard.edu/abs/2020SPIE11454E..35Z/abstract
2020, Dec 16	H.-J. Lee, J. Ďurech, D. Vokrouhlický, et al., 2020, <i>Astronomical Journal</i>, in press, e-print <i>arXiv:2012.08771</i>, “Spin change of asteroid 2012 TC4 probably by radiation torques.” See: https://ui.adsabs.harvard.edu/abs/2020arXiv201208771L/abstract
2020, Dec 16	Apollo NEA 2020 XF4 ($H = 27.5$ mag, $D \approx 11$ m) passed Earth at a nominal miss distance of 0.89 LD. Minimum miss distance 0.89 LD. [2020-102] See: 2020 XF4 – S2P , 2020 XF4 – JPL Discovery station: Mt. Lemmon Survey

	See: http://iawn.net/
2020, Dec 18	Apollo NEA 2020 XX3 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.15 LD. Minimum miss distance 0.15 LD. [2020-103] See: 2020 XX3 – S2P , 2020 XX3 – JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2020, Dec 19	Anon., 2020, <i>SciTechDaily</i>, 19 December 2020, “Next target [1998KY26] asteroid for Hayabusa2 photographed by Subaru telescope.” See: https://scitechdaily.com/next-target-asteroid-for-hayabusa2-photographed-by-subaru-telescope/ See also: http://www.hayabusa2.jaxa.jp/enjoy/material/press/Hayabusa2_Press_2020_0915_ver9_en2.pdf http://www.parabolicarc.com/2020/09/22/hayabusa2-to-visit-rapidly-spinning-asteroid-in-extended-mission/ https://www.space.com/japan-hayabusa2-asteroid-probe-extended-mission
2020, Dec 19	Apollo NEA 2020 YR2 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [2020-104] See: 2020 YR2 – S2P , 2020 YR2 – JPL Discovery station: Mt Lemmon Survey See: http://iawn.net/
2020, Dec 20	Aten NEA 2020 YS2 ($H = 31.0$ mag, $D \approx 2.2$ m) passed Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.23 LD. [2020-105] See: 2020 YS2 – S2P , 2020 YS2 – JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2020, Dec 21	Anon., 2020, <i>planetary.org</i>, “NASA's budget for fiscal year (FY) 2021.” ... called for a 2025 launch of the NEO Surveyor mission, which would help identify potentially hazardous asteroids. ... See: https://www.planetary.org/space-policy/nasas-fy-2021-budget#
2020, Dec 21	V.E. Hamilton, C.A. Goodrich, A.H. Treiman, et al., 2020, <i>Nature Astronomy</i>, 21 December 2021, “Meteoritic evidence for a Ceres-sized water-rich carbonaceous chondrite parent asteroid.” See: https://www.nature.com/articles/s41550-020-01274-z
2020, Dec 21	J.-L. Margot, 2020, <i>Journal of Astronomical Instrumentation</i> , Online

	Ready, 21 December 2020, “A data-taking system for planetary radar applications.” See: https://ui.adsabs.harvard.edu/abs/2021JAI...1050001M/abstract
2020, Dec 21	Apollo NEA 2020 YJ2 ($H = 27.3$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.89 LD. Minimum miss distance 0.89 LD. [2020-106] See: 2020 YJ2 – S2P , 2020 YJ2 – JPL Discovery station: Tokyo-Kiso See: http://iawn.net/
2020, Dec 22	Apollo NEA 2020 YN2 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 1.02 LD. Minimum miss distance 1.02 LD. See: 2020 YN2 – S2P , 2020 YN2 – JPL See also: 22 Dec 2097.
2020, Dec 28	Ö. Karatekin, V. Dehant, 2020, <i>Press Release Royal Observatory of Belgium</i>, 28 December 2020, “The Royal Observatory of Belgium and EMXYS receive go for participation in planetary defence Hera space mission.” See: https://www.astro.oma.be/en/the-royal-observatory-of-belgium-and-emxys-receive-go-for-participation-in-planetary-defence-hera-space-mission/ The Royal Observatory of Belgium and EMXYS (Spain) have been selected by the European Space Agency to provide a gravimeter for the Juventas spacecraft that will land on asteroid Dimorphos as part of the European Space Agency’s planetary defence programme. The Royal Observatory of Belgium with EMXYS will provide the GRASS instrument that will make measurements on the gravity field of the asteroid Dimorphos. The gravimeter is part of the Juventas CubeSat, manufactured by GomSpace Luxemburg, that will land on the asteroid in 2027, after travelling onboard the ESA’s Hera spacecraft to its vicinity. GRASS will be the first gravimeter ever on an asteroid. Due for launch in 2024, Hera is the European contribution to an international double-spacecraft collaboration to a binary asteroid system: The 780 m-diameter main body Didymos is orbited by a 160 m moon, Dimorphos. NASA’s DART mission will first perform a kinetic impact on Dimorphos, then Hera will follow up with a detailed post-impact survey that will turn this grand-scale experiment into a well understood and repeatable planetary defence technique.
2020, Dec 28	Apollo NEA 2020 YS4 ($H = 27.7$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.25 LD. Minimum miss distance 0.25 LD. [2020-107] See: 2020 YS4 – S2P , 2020 YS4 – JPL Discovery station: Mt Lemon Survey

	See: http://iawn.net/
2020, Dec 30	M.V. Sergienko, M.G. Sokolova, Yu.A. Nefedyev, A.O. Andreev, 2020, <i>Astronomy Reports</i> , 64, 1087, "The κ-Cygnid meteor shower and its relationship with Near-Earth Asteroids." See: https://ui.adsabs.harvard.edu/abs/2020ARep...64.1087S/abstract
2020, Dec 30	A. Siraj, A. Loeb, 2020, <i>Planetary Science Journal</i> , 1, 86, "Risks for life on Proxima b from sterilizing asteroid impacts." See: https://ui.adsabs.harvard.edu/abs/2020PSJ.....1...86S/abstract See also: http://astrobiology.com/2020/06/risks-for-life-on-proxima-b-from-sterilizing-asteroid-impacts.html
2021, Jan 1	24728 NEAs known (ranging in size up to ~37 km: 1036 Ganymed , A924 UB , $H = 9.45$ mag, $D = 36.5$ km, Amor NEA), of which 2148 PHAs (ranging in size from 140 m up to ~5 km: 4179 Toutatis , 1989 AC , $H = 15.3$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, Apollo NEA, PHA). See: https://cneos.jpl.nasa.gov/stats/totals.html
2021	[project cancelled] Expected launch of NASA robotic spacecraft Asteroid Redirect Mission (ARM) . Potential targets: 2010 MD ($D \approx 6$ m), 2008 HU4 ($D \approx 8$ m), 2009 BD ($D \approx 3 - 4$ m). See: https://www.nasa.gov/arm http://www.jpl.nasa.gov/news/news.php?release=2014-052 http://www.jpl.nasa.gov/news/news.php?release=2014-193 http://www.jpl.nasa.gov/news/news.php?release=2014-195 http://www.nasa.gov/jpl/spitzer/asteroid-infrared-20140619/ https://www.nasa.gov/content/what-is-nasa-s-asteroid-redirect-mission http://www.nasa.gov/mission_pages/asteroids/initiative/index.html http://www.nasa.gov/asteroidforum/ http://www.nasa.gov/press/2015/march/nasa-announces-next-steps-on-journey-to-mars-progress-on-asteroid-initiative/ http://www.space.com/34834-nasa-asteroid-mission-robot-prototype-photo.html https://www.space.com/39050-trump-directs-nasa-humans-to-moon.html http://en.wikipedia.org/wiki/Asteroid_Redirect_Mission Ref: - M. Mommert, D. Farnocchia, J.L. Hora, et al., July 2014, <i>Astrophysical Journal</i> (Letters), 789, L22, "Physical properties of Near-Earth Asteroid 2011 MD ." See: http://adsabs.harvard.edu/abs/2014ApJ...789L..22M
2021, Jan	A. Amarante, O.C. Winter, R. Sfair, 2021, <i>Journal of Geophysical</i>

	<i>Research: Planets</i>, 126, e06272, “Stability and evolution of fallen particles around the surface of asteroid (101955) Bennu.” See: https://ui.adsabs.harvard.edu/abs/2021JGRE..12606272A/abstract
2021, Jan	S.D. Baum, 2021, <i>Acta Astronautica</i>, 178, 15, “Accounting for violent conflict risk in planetary defense decisions.” See: https://ui.adsabs.harvard.edu/abs/2021AcAau.178...15B/abstract
2021, Jan	M. Ehresmann, 2021, <i>Acta Astronautica</i>, 178, 672, “Asteroid control through surface restructuring.” See: https://ui.adsabs.harvard.edu/abs/2021AcAau.178..672E/abstract
2021, Jan	R. Garmier, A. Torres, T. Martin, et al., 2021, <i>Planetary and Space Science</i>, 195, 105150, “Attitude reconstruction of MASCOT lander during its descent and stay on asteroid (162173) Ryugu.” See: https://ui.adsabs.harvard.edu/abs/2021P%26SS..19505150G/abstract
2021, Jan	J.-N. Huang, K. Muinonen, T. Chen, X.-B. Wang, 2021, <i>Planetary and Space Science</i>, 195, 105120, “Photometric study for near-Earth asteroid (155140) 2005 UD.” See: https://ui.adsabs.harvard.edu/abs/2021P%26SS..19505120H/abstract
2021, Jan	Y. Huang, B. Gladman, 2021, <i>Monthly Notices of the Royal Astronomical Society</i>, 500, 1151, “Four-billion year stability of the Earth-Mars belt.” See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.500.1151H/abstract
2021, Jan	K.A. Otto, K.-D. Matz, S.E. Schröder, et al., 2021, <i>Monthly Notices of the Royal Astronomical Society</i>, 500, 3178, “Surface roughness of asteroid (162173) Ryugu and comet 67P/Churyumov–Gerasimenko inferred from <i>in situ</i> observations.” See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.500.3178O/abstract
2021, Jan	G. Purpura, P. Di Lizia, 2021, <i>Council of European Aerospace Societies Space Journal</i>, 13, 65, “Autonomous GNC strategy for an asteroid impactor mission.” See: https://ui.adsabs.harvard.edu/abs/2021CEAS...13...65P/abstract
2021, Jan	T. Saiki, Y. Takei, T. Takahashi, et al., 2021, <i>Transactions of the Japan Society for Aeronautical and Space Sciences, Aerospace Technology Japan</i>, 19, 52, “Overview of Hayabusa2 asteroid proximity operation planning and preliminary results.” See: https://ui.adsabs.harvard.edu/abs/2021JSAST..19...52S/abstract
2021, Jan	I. Włodarczyk, 2021, <i>Monthly Notices of the Royal Astronomical Society</i>, 500, 3569, “Orbital evolution of Mars-crossing asteroids.”

	See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.500.3569W/abstract
2021, Jan 1	A.G.V. de Brum, H. Hussmann, K. Wickhusen, A. Stark, 2021, <i>Advances in Space Research</i> , 67, 648, “Encounter trajectories for deep space mission ASTER to the triple near Earth asteroid 2001 SN263 . The laser altimeter (ALR) point of view.” See: https://ui.adsabs.harvard.edu/abs/2021AdSpR..67..648D/abstract
2021, Jan 1	Apollo NEA 2021 AA ($H = 26.9$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.61 LD. [2021-01] See: 2021 AA – S2P , 2021 AA - JPL Discovery station: Mt Lemon Survey See: http://iawn.net/
2021, Jan 3	Apollo NEA 2021 AH ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.13 LD. Minimum miss distance 0.13 LD. [2021-02] See: 2021 AH – S2P , 2021 AH - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2021, Jan 4	K. Kitazato, R.E. Milliken, [...] Y. Tsuda, 2021, <i>Nature Astronomy</i> , 5, 246, “Thermally altered subsurface material of asteroid (162173) Ryugu .” See: https://ui.adsabs.harvard.edu/abs/2021NatAs...5..246K/abstract
2021, Jan 4	Apollo NEA 2021 AH8 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.14 LD. Minimum miss distance 0.14 LD. [2021-03] See: 2021 AH8 – S2P , 2021 AH8 - JPL Discovery station: Mt Lemon Survey See: http://iawn.net/
2021, Jan 5	ESA NEOCC Newsletter. January 2021. See: http://neo.ssa.esa.int/newsletters [January 2021] http://neo.ssa.esa.int/neooc-riddles
2021, Jan 8	S. Turner, L. McGee, M. Humayun, et al., 2021, <i>Science</i> , 371, 164, “Carbonaceous chondrite meteorites experienced fluid flow within the past million years.” See: https://science.sciencemag.org/content/371/6525/164 See also: https://www.space.com/meteorites-flow-water-ice-asteroids
2021, Jan 9, 03:09	Apollo NEA 2021 AC4 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 1.005 LD. Minimum miss distance 1.002

	LD. See: 2021 AC4 – S2P , 2021 AC4 - JPL
2021, Jan 9, 09:38	Apollo NEA 2021 AS2 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.28 LD. [2021-04] See: 2021 AS2 – S2P , 2021 AS2 - JPL Discovery station: Mt Lemon Survey See: http://iawn.net/
2021, Jan 11-15	American Astronomical Society 237th Meeting , Phoenix (AZ, USA), 3-7 January 2021, rescheduled for a virtual meeting, 11-15 January 2021. See: https://aas.org/meetings/aas237 Among the abstracts: - K.M. Fasbender, D. Nidever, 2021, <i>AAS meeting</i> #237, id. 405.06, “ CANFind : solar system object detection in the NOAO Source Catalog.” See: https://ui.adsabs.harvard.edu/abs/2021AAS...23740506F/abstract - D. Trilling, 2021, <i>AAS meeting</i> #237, id. 423.06, “The Solar System Notification Alert Processing System (SNAPS).” See: https://ui.adsabs.harvard.edu/abs/2021AAS...23742306T/abstract
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2021, Jan 15	S.H. Halim, N. Barrett, S.J. Boazman, et al., 2021, <i>Icarus</i> , 354, 113992, “Numerical modeling of the formation of Shackleton crater at the lunar south pole.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..35413992H/abstract
2021, Jan 15	N. Hirata, N. Namiki, F. Yoshida, et al., 2021, <i>Icarus</i> , 354, 114073, “Rotational effect as the possible cause of the east-west asymmetric crater rims on Ryugu observed by LIDAR data.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..35414073H/abstract
2021, Jan 15	M. Mahlke, B. Carry, L. Denneau, 2021, <i>Icarus</i> , 354, 114094,

	“Asteroid phase curves from ATLAS dual-band photometry.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..35414094M/abstract
2021, Jan 15	R. Noguchi, N. Hirata, N. Hirata, et al., 2021, <i>Icarus</i>, 354, 114016, “Crater depth-to-diameter ratios on asteroid 162173 Ryugu.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..35414016N/abstract
2021, Jan 16	Apollo NEA 2021 BR2 ($H = 30.9$ mag, $D \approx 2.4$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2021-05] See: 2021 BR2 – S2P , 2021 BR2 - JPL Discovery station: Mt Lemon Survey See: http://iawn.net/
2021, Jan 18, 01:16	Apollo NEA 2021 BK ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.29 LD. Minimum miss distance 0.29 LD. [2021-06] See: 2021 BK – S2P , 2021 BK - JPL Discovery station: Mt Lemon Survey See: http://iawn.net/
2021, Jan 18, 01:44	Apollo NEA 2021 BV1 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2021-07] See: 2021 BV1 – S2P , 2021 BV1 - JPL Discovery station: Pan-STARRA 1, Haleakala See: http://iawn.net/
2021, Jan 18, 08:09	Apollo NEA 2021 BO ($H = 33.0$ mag, $D \approx 0.9$ m) passed Earth at a nominal miss distance of 0.0624 LD (= 3.77 R_{Earth} from the geocenter). Minimum miss distance 0.0624 LD (= 3.76 R_{Earth} from the geocenter). [2021-08] See: 2021 BO – S2P , 2021 BO - JPL Discovery station: Mt Lemon Survey See: http://iawn.net/ See also: 19 Jan 2136. Possibly the second-smallest asteroid ever discovered in space. See: http://neo.ssa.esa.int/newsletters [February 2021]
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2021, Jan 20	Apollo NEA 2021 BO1 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2021-09] See: 2021 BO1 – S2P , 2021 BO1 - JPL Discovery station: Mt Lemon Survey See: http://iawn.net/
2021, Jan 26	Apollo NEA 2018 BA3 ($H = 26.5$ mag, $D \approx 18$ m) passed Earth at a nominal miss distance of 0.97 LD. Minimum miss distance 0.74 LD. [2021-10] See: 2018 BA3 - SSA , 2018 BA3 - JPL
2021, Jan 26	Anon., 2021, <i>Emirates News Agency</i>, 26 January 2021, “Sharjah Astronomical Observatory detects rare sequential impacts on Moon.” See: http://wam.ae/en/details/1395302904554
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2021, Jan 26-27	24th Meeting of the NASA Small Bodies Assessment Group, 26 -27 Jan 2021, virtual. See: http://www.lpi.usra.edu/sbag/meetings/ Presentations: See: https://www.lpi.usra.edu/sbag/meetings/jan2021/SBAG2021-AgendaPreliminary-LG.pdf https://www.lpi.usra.edu/sbag/meetings/jan2021/ - L.S. Glaze, 2021, “Planetary Science Division overview.” See: https://www.youtube.com/watch?v=2YxNw2oM_Ii&list=PLQ7WzZtg-qMBaWCiIbcYj5S9PkrJ1M2W1L&index=13 - R. Binzel, 2021, “Apophis Workshop summary and the path ahead.” See: https://www.youtube.com/watch?v=v7C6klg7ZBU&list=PLQ7WzZtg-

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2021, Jan 28 – Feb	43rd COSPAR Scientific Assembly , 15–22 August 2020, Sydney (Australia). Rescheduled for: 28 January – 4 February 2021. See: https://www.cospar2020.org https://mailchi.mp/cosparhq.cnes.fr/cospar-2020-scientific-assembly-postponed https://mailchi.mp/cosparhq/cospar-2020-scientific-assembly-postponed-6411865 https://mailchi.mp/cosparhq.cnes.fr/cospar-news-issue-7 In the Scientific Program: B1.1 Small Body exploration science in the new decade. B1.2 Asteroids, friends or foe: Planetary Defense and resources.
2021, Feb	E.B. Bierhaus, J.T. Songer, B.C. Clark, et al., 2021, <i>Icarus</i> , 355, 114142, “ Bennu regolith mobilized by TAGSAM : expectations for the OSIRIS-REx sample collection event and application to understanding naturally ejected particles.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..35514142B/abstract
2021, Feb	C. de la Fuente Marcos, R. de la Fuente Marcos, 2021, <i>Research Notes of the AAS</i> , 5, 29, “Transient terrestrial Trojans : comparative short-term dynamical evolution of 2010 TK7 and 2020 XL5 .” See: https://ui.adsabs.harvard.edu/abs/2021RNAAS...5...29D/abstract

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2021, Feb 1-12	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) Scientific and Technical SubCommittee, 58th Session, 4-12 February 2021, rescheduled for 19-30 April 2021, Vienna (Austria), VIC Online. See: https://www.unoosa.org/oosa/en/ourwork/copuos/stsc/2021/index.html https://www.unoosa.org/documents/pdf/copuos/stsc/2021/VIC_Meeting_Guidelines_Covid_19_Participants_20201125_V1.pdf http://www.unoosa.org/oosa/en/ourwork/topics/neos/index.html https://news.yahoo.com/nasa-un-sign-memorandum-understanding-172900649.html
2021, Feb 2	12th International Asteroid Warning Network Steering Committee Meeting, 2 February 2021, Vienna (Austria) or virtual. Postponed till 30-31 March 2021. See: http://iawn.net/meetings.shtml http://iawn.net/meetings/11-steering-cmte.shtml
2021, Feb 2	2020 SO ($H = 28.4$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.59 LD See: 2020 SO – S2P , 2020 SSO - JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/ Upper Centaur rocket booster from the 1960's. See also: 1 Dec 2020. See also: https://edition.cnn.com/2020/09/23/us/mini-moon-scnd-trnd/index.html https://www.sciencealert.com/earth-might-be-about-to-get-a-temporary-minimoon-but-what-is-it https://www.space.com/earth-minimoon-2020-so-may-be-vintage-space-junk

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2021, Feb 3	16th Meeting Space Mission Planning Advisory Group (SMPAG) , 3 February 2021, Vienna (Austria) or virtual. Postponed till 24-25 March 2021. See: https://www.cosmos.esa.int/web/smpag/ https://www.cosmos.esa.int/web/smpag/meeting_15_-_sep_2020
2021, Feb 4	Apollo NEA 2021 CV ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.52 LD. Minimum miss distance 0.52 LD. [2021-11] See: 2021 CV – S2P , 2021 CV – JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2021, Feb 5	D. Greenbaum, 2021, <i>Science</i> , 371, 579, “The origins of ‘ Oumuamua .” See: https://ui.adsabs.harvard.edu/abs/2021Sci...371..579G/abstract
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2021, Feb 5	ESA NEOCC Newsletter. February 2021. See: http://neo.ssa.esa.int/newsletters [February 2021] http://neo.ssa.esa.int/neocc-riddles
2021, Feb 7	R. Santos, M. Xu, Y. Zheng, et al., 2021, <i>Journal of Spacecraft and Rockets</i> , 58, 1207, “Conceptual design for deflecting a potentially hazardous asteroid with a space duster.” See: https://ui.adsabs.harvard.edu/abs/2021JSpRo..58.1207S/abstract
2021, Feb 9	J. Borovička, F. Bettonvil, G. Baumgarten, et al., 2021, <i>Meteoritics & Planetary Science</i> , Early View, “Trajectory and orbit of the unique carbonaceous meteorite Flensburg .” See: https://onlinelibrary.wiley.com/doi/10.1111/maps.13628
2021, Feb 9	Apollo NEA 2021 CZ3 ($H = 31.0$ mag, $D \approx 2.3$ m) passed Earth at a nominal miss distance of 0.0593 LD (= 3.58 R_{Earth} from the geocenter). Minimum miss distance 0.0593 LD.

	[2021-12] See: 2021 CZ3 – S2P , 2021 CZ3 – JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
2021, Feb 11	H.-J. Lee, J. Ďurech, D. Vokrouhlický, et al., 2021, <i>Astronomical Journal</i>, 161, 112, “Spin change of asteroid 2012 TC4 probably by radiation torques.” See: https://ui.adsabs.harvard.edu/abs/2021AJ....161..112L/abstract
2021, Feb 11, 15:22	Apollo NEA 2021 CO ($H = 25.3$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 0.94 LD. Minimum miss distance 0.94 LD. [2021-13] See: 2021 CO – S2P , 2021 CO – JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2021, Feb 11, 22:35	Apollo NEA 2021 CQ5 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.46 LD. Minimum miss distance 0.46 LD. [2021-14] See: 2021 CQ5 – S2P , 2021 CQ5 – JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/ See also: 12 Feb 2076.
2021, Feb 12, 10:59	Apollo NEA 2021 CC6 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.44 LD. Minimum miss distance 0.44 LD. [2021-15] See: 2021 CC6 – S2P , 2021 CC6 – JPL Discovery station: Kitt Peak-Bok See: http://iawn.net/
2021, Feb 12, 20:27	Apollo NEA 2021 CC7 ($H = 29.6$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2021-16] See: 2021 CC7 – S2P , 2021 CC7 – JPL Discovery station: Tokyo-Kiso See: http://iawn.net/
2021, Feb 13	Apollo NEA 2021 CA6 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2021-17] See: 2021 CA6 – S2P , 2021 CA6 – JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 14 Feb 1936 , 12 Feb 2054.

2021, Feb 14, 12:09	Apollo NEA 2021 CS6 ($H = 27.8$ mag, $D \approx 10$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2021-18] See: 2021 CS6 – S2P , 2021 CS6 – JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2021, Feb 14, 16:14	Apollo NEA 2021 CW7 ($H = 31.0$ mag, $D \approx 2.2$ m) passed Earth at a nominal miss distance of 0.073 LD (= 4.40 R_{Earth} from the geocenter). Minimum miss distance 0.073 LD. [2021-19] See: 2021 CW7 – S2P , 2021 CW7 – JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
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2021, Feb 17	A.C. Rabeendran, L. Denneau, 2021, <i>Publications of the Astronomical Society of the Pacific</i>, 133, 034501, “A two-stage deep learning detection classifier for the ATLAS asteroid survey.” See: https://ui.adsabs.harvard.edu/abs/2021PASP..133c4501C/abstract
2021, Feb 18, 03:18	Apollo NEA 2021 DN1 ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.88 LD. [2021-20] See: 2021 DN1 – S2P , 2021 DN1 – JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
2021, Feb 18, 14:21	Apollo NEA 2021 DG ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2021-21] See: 2021 DG – S2P , 2021 DG – JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 18 Feb 1980, 19 Feb 2031.

2021, Feb 19	J.I. Katz, 2021, e-print <i>arXiv:2102.07871</i> , “ Oumuamua is not artificial.” See: https://ui.adsabs.harvard.edu/abs/2021arXiv210207871K/abstract
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	“Photometry of asteroid (101955) Bennu with OVIRS on OSIRIS-REx.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..35814183Z/abstract
2021, Apr 2	M.R. Carvalho, C. Jaramillo, F. de la Parra, et al., 2021, <i>Science</i>, 372, 63, “Extinction at the end-Cretaceous and the origin of modern Neotropical rainforests.” See: https://science.sciencemag.org/content/372/6537/63
2021, Apr 3	Apollo NEA 2021 GE2 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2021-34] See: 2021 GE2 – S2P , 2021 GE2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 2 Apr 1942, 2 Apr 2030.
2021, Apr 4	Apollo NEA 2021 GV ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.87 LD. Minimum miss distance 0.87 LD. [2021-35] See: 2021 GV – S2P , 2021 GV - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2021, Apr 5	E.A. Pavlova, M.V. Zakhvatkin, A.I. Streltsov, et al., 2021, <i>Cosmic Research</i>, 59, 104, “Development of the common classification of hazard events in near-Earth space.” See: https://ui.adsabs.harvard.edu/abs/2021CosRe..59..104P/abstract
2021, Apr 5, 09:06	Apollo NEA 2021 GS ($H = 28.7$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2021-36] See: 2021 GS – S2P , 2021 GS - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2021, Apr 5, 18:39	Apollo NEA 2021 GZ7 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2021-37] See: 2021 GZ7 – S2P , 2021 GZ7 - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
2021, Apr 6	ESA NEOCC Newsletter. April 2021. See: http://neo.ssa.esa.int/newsletters [April 2021] http://neo.ssa.esa.int/neocc-riddles

2021, Apr 7	N. Golovich, N. Lifset, R. Armstrong, et al., 2021, e-print <i>arXiv:2104.03411</i> , “A new blind asteroid detection scheme.” See: https://ui.adsabs.harvard.edu/abs/2021arXiv210403411G/abstract
2021, Apr 8	G.V. Borisov, B.M. Shustov, 2021, <i>Solar System Research</i> , 55, 124, “Discovery of the first interstellar comet and the spatial density of interstellar objects in the solar neighborhood.” See: https://ui.adsabs.harvard.edu/abs/2021SoSyR..55..124B/abstract
2021, Apr 8	V.V. Shuvalov, 2021, <i>Solar System Research</i> , 55, 97, “Release of matter into the atmosphere during the fall of ten-kilometer asteroids into the ocean.” See: https://ui.adsabs.harvard.edu/abs/2021SoSyR..55...97S/abstract
2021, Apr 8	Apollo NEA 2021 GV4 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.82 LD. [2021-38] See: 2021 GV4 – S2P , 2021 GV4 - JPL Discovery station: Tokyo-Kiso See: http://iawn.net/
2021, Apr 9	Aten/Apollo NEA 2021 GL16 ($H = 26.2$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.96 LD. [2021-39] See: 2021 GL16 – S2P , 2021 GL16 – JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2021, Apr 10	Apollo NEA 2021 GT3 ($H = 26.4$ mag, $D \approx ..$ m) passed Earth at a nominal miss distance of 0.67 LD. Minimum miss distance 0.66 LD. [2021-40] See: 2021 GT3 – S2P , 2021 GT3 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2021, Apr 11	M. Ntumba, S. Gore, J.-B. Awanyo, 2021, e-print <i>arXiv:2104.06249</i> , “Prediction of Apophis asteroid flyby optimal trajectories and data fusion of Earth-Apophis mission launch windows using deep neural networks.” See: https://ui.adsabs.harvard.edu/abs/2021arXiv210406249N/abstract
2021, Apr 11	Aten NEA 2021 GQ5 ($H = 28.6$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.97 LD. Minimum miss distance 0.97 LD. [2021-41]

	See: 2021 GQ5 – S2P , 2021 GQ5 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2021, Apr 12	Apollo NEA 2021 GW4 ($H = 29.5$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.0682 LD (= 4.112 R_{Earth} from the geocenter). Minimum miss distance 0.0681 LD. [2021-42] See: 2021 GW4 – S2P , 2021 GW4 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 12 Apr 2176. See also: https://www.space.com/near-earth-asteroid-close-approach-2021-gw4
2021, Apr 13, 02:36	Apollo NEA 2021 GC13 ($H = 29.1$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.89 LD. Minimum miss distance 0.89 LD. [2021-43] See: 2021 GC13 – S2P , 2021 GC13 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2021, Apr 13, 22:05	Apollo NEA 2021 GC8 ($H = 30.6$ mag, $D \approx 2.7$ m) passed Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.57 LD. [2021-44] See: 2021 GC8 – S2P , 2021 GC8 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2021, Apr 14, 05:29	Aten/Apollo NEA 2021 GQ10 ($H = 26.7$ mag, $D \approx 17$ m) passed Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.45 LD. [2021-45] See: 2021 GQ10 – S2P , 2021 GQ10 - JPL Discovery station: 381 Tokyo-Kiso See: http://iawn.net/
2021, Apr 14, 21:54	Apollo NEA 2021 GW16 ($H = 30.1$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.0760 LD (= 4.59 R_{Earth} from the geocenter). Minimum miss distance 0.0759 LD. [2021-46] See: 2021 GW16 – S2P , 2021 GW16 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2021, Apr 15	J. Rojas, J. Duprat, C. Engrand, et al., 2021, <i>Earth and Planetary Science Letters</i>, 560, 116794, “The micrometeorite flux at Dome C

	(Antarctica), monitoring the accretion of extraterrestrial dust on Earth.” See: https://ui.adsabs.harvard.edu/abs/2021E%26PSL.56016794R/abstract See also: https://www.cnrs.fr/en/more-5000-tons-extraterrestrial-dust-fall-earth-each-year
2021, Apr 15, 04:44	Apollo NEA 2021 HC1 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.60 LD. Minimum miss distance 0.60 LD. [2021-47] See: 2021 HC1 – S2P , 2021 HC1 - JPL Discovery station: MAP, San Pedro de Atacama See: http://iawn.net/
2021, Apr 15, 09:29	Apollo NEA 2021 GF10 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.30 LD. Minimum miss distance 0.30 LD. [2021-48] See: 2021 GF10 – S2P , 2021 GF10 - JPL Discovery station: MAP, San Pedro de Atacama See: http://iawn.net/
2021, Apr 15, 22:31	Apollo NEA 2021 GN10 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.75 LD. [2021-49] See: 2021 GN10 – S2P , 2021 GN10 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2021, Apr 17	Apollo NEA 2021 HE1 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.59 LD. Minimum miss distance 0.59 LD. [2021-50] See: 2021 HE1 – S2P , 2021 HE1 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/ See also: 20 Apr 2124.
2021, Apr 19	Apollo NEA 2021 HN ($H = 26.9$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.66 LD. Minimum miss distance 0.66 LD. [2021-51] See: 2021 HN – S2P , 2021 HN - JPL Discovery station: GINOP-KHK, Piszkesteto See: http://iawn.net/
2021, Apr 19-30	UN - Committee on the Peaceful Uses of Outer Space (UN-COPUOS) Scientific and Technical SubCommittee, 58th Session, 1–12 February 2021, rescheduled for 19-30 April 2021, Vienna (Austria).

	See: https://www.unoosa.org/oosa/en/ourwork/copuos/stsc/2021/index.html https://www.unoosa.org/documents/pdf/copuos/stsc/2021/VIC_Meeting_Guidelines_Covid_19_Participants_20201125_V1.pdf https://www.unoosa.org/documents/pdf/copuos/stsc/2021/Remote_Conferences_visual.pdf http://www.unoosa.org/oosa/en/ourwork/topics/neos/index.html https://news.yahoo.com/nasa-un-sign-memorandum-understanding-172900649.html Among the technical presentations: - Y. Tsuda, 2021, “Achievements of Hayabusa2: unveiling the world of asteroid by interplanetary round trip technology.” See: https://www.unoosa.org/documents/pdf/copuos/stsc/2021/tech-28E.pdf
2021, Apr 20	D. Kuroda, J. Geem, H. Akitaya, et al., 2021, <i>Astrophysical Journal Letters</i>, 911, L24, “Implications of high polarization degree for the surface state of Ryugu.” See: https://ui.adsabs.harvard.edu/abs/2021ApJ...911L..24K/abstract
2021, Apr 21	A. Tsuchiyama, A. Miyake⁴, S. Okuzumi, et al., 2021, <i>Science Advances</i>, 7, eabg9707, “Discovery of primitive CO₂-bearing fluid in an aqueously altered carbonaceous chondrite.” See: https://advances.sciencemag.org/content/7/17/eabg9707 See also: http://www.ritsumei.ac.jp/research/member/news/detail/?id=270
2021, Apr 22	B. Bucha, F. Sansò, 2021, <i>Journal of Geodesy</i>, 95, 56, “Gravitational field modelling near irregularly shaped bodies using spherical harmonics: a case study for the asteroid (101955) Bennu.” See: https://ui.adsabs.harvard.edu/abs/2021JGeod..95...56B/abstract
2021, Apr 23	P. Jenniskens, M. Gabbadire, Q.- Z. Yin, et al., 2021, <i>Meteoritics & Planetary Science</i>, 56,844, “The impact and recovery of asteroid 2018 LA,” See: https://ui.adsabs.harvard.edu/abs/2021M%26PS...56..844J/abstract See also: https://www.seti.org/press-release/asteroid-hit-botswana-2018-likely-came-vesta https://www.seti.org/sites/default/files/2021-04/Poster-Jenniskens-PDC2021-Asteroid2018LA.pdf https://www.seti.org/press-release/fragment-impacting-asteroid-recovered-botswana-0
2021, Apr 25	Atira (IEO) NEA 2021 PH27 ($H = 17.73$ mag, $D \approx 1000$ m) passed Earth at a nominal miss distance of 0.35 AU (= 136 LD). Minimum miss distance 0.34 AU (= 133 LD). See: 2021 PH27 – S2P , 2021 PH27 – JPL Discovery station: Cerro Tololo Observatory, La Serena

	See also: https://www.minorplanetcenter.net/mpec/K21/K21Q41.html https://noirlab.edu/public/news/noirlab2123/ https://www.space.com/solar-system-fastest-orbiting-asteroid-2021-ph27 https://en.wikipedia.org/wiki/2021_PH27 See also: 1 May 2031.
2021, Apr 26	O. Vaduvescu, R. Cornea, A. Aznar Macias, et al., 2021, <i>Earth, Moon, and Planets</i>, 125, 3, “The EURONEAR lightcurve survey of Near Earth Asteroids—Teide Observatory, Tenerife, 2015.” See: https://ui.adsabs.harvard.edu/abs/2021EM%26P..125....3V/abstract
2021, Apr 26-30	7th International Academy of Astronautics (IAA) Planetary Defense Conference, 26-30 April 2021, virtual conference. See: https://iaaspace.org/event/7th-iaa-planetary-defense-conference-2021/ https://atpi.eventsair.com/QuickEventWebsitePortal/7th-iaa-planetary-defense-conference-2021/website/Agenda See also: http://neo.ssa.esa.int/newsletters [December 2020] Preliminary programme of oral presentations: See: https://atpi.eventsair.com/QuickEventWebsitePortal/7th-iaa-planetary-defense-conference-2021/website/Agenda Day 1, Tuesday, 27 April 2021 KEYNOTE by Director of the UN Office for Outer Space Affairs, Simonetta Di Pippo ADDRESS by Chair of the Committee on the Peaceful Uses of Outer Space, Marius Piso Session 1: <i>Hera</i> - P. Michel, 2021, “The ESA Hera mission: planetary defence and science return.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/333d4d900f8a42b2bf912e294626f5f4 - M. Küppers, 2021, “The measurement goals and payload of the Hera mission to Dimorphos.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/2762140fc01541d0a3c295016b5f2d13 - F. Toppo, 2021, “The Hera Milani CubeSat mission.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/036dc338eac84fcb5ada8576cb43082 - O. Karatekin, 2021, “Juventas Cubesat for the Hera mission.” Session 2: <i>Hayabusa2</i> - Y. Tsuda, 2021, “Summary of Hayabusa2 mission.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/c82d899151b949efb7e915dfb0593df3 - T. Saiki, H. Imamura, H. Sawada, et al., 2021, “Hayabusa2’s

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	kinetic impactor.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/2342b8db1e294e7c83683598b9b0c00a - M. Arakawa, K. Wada, K. Ogawa, et al., 2021, “Artificial impact crater on Ryugu formed in the gravity dominated regime.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/175bd8c820f94e278cd04bfd00ca3b8a - S. Sugita, T. Morota, R. Honda, et al., 2021, “Physical properties of Ryugu revealed by proximity observations with Hayabusa2 science instruments.” - T. Okada, S. Tanaka, N. Sakatani, et al., 2021, “Thermal imaging to reveal the highly porous nature of C-type asteroid Ryugu in Hayabusa2 mission.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/931bc6d5811e45ee9f1a3095c1be5f3e - M. Hirabayashi, Y. Kim, Y. Mimasu, et al., 2021, “Hayabusa2 extended mission to rendez-vous with asteroid 1998 KY26: investigations of a extremely small fast rotator for planetary defense.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/1883c6477aaa4941b4897317b0cba574 EXERCISE SESSION: First notice of (hypothetical) threat Session 3: DART - T.S. Statler, 2021, “Overview of the DART mission seven months to launch.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/c3e6a28b5e8945af9306076e47e12da8 - E. Adams, 2021, “DART mission status.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/6fbb31040935429f90cbb68736b66bdb - E. Dotto, V. Della Corte, E. Mazzotta Epifani, et al., 2021, “Spacecraft and technology, SmartNav & terminal approach, data to be returned by DART and LICIACube.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/49a8f1f53d17424b9502444ffbd2c9ce - A. Rivkin, 2021, “Pre- and postimpact observations, potentially detectable dynamical effects.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/6fbb31040935429f90cbb68736b66bdb - A. Cheng, 2021, “DART “legacy”: determination of beta, data archive, kinetic impactor demonstration.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/c63591e28085431c9331fe465fc0f7a1 Session 4: OSIRIS-REx - A.A. Simon, 2021, “Overview and highlights of the OSIRIS-REx mission.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/6fbb31040935429f90cbb68736b66bdb

	public/acd604321cdf462591f19cc740cf8204 - R. Balouz, R.T. Daly, O.S. Barnouin, et al., 2021, “Constraining the strength of 100-m scale asteroids through craters on Bennu’s boulders and NEO population estimates.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/9d64d4b9e5804a03a1d7e1b0714f2162 - B. Bierhaus, 2021, “Bennu craters in the context of planetary defense.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/a093edfb0ae6485cb579a20ffb69af2b - M.C. Nolan, J.M. Leonard, D.J. Scheeres, et al., 2021, “Observations of Bennu’s increasing rotation rate, YORP, and implications for Bennu’s evolution.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/3c51d4b637304396ac7dc6b317199087 Day 2, Wednesday, 28 April 2021 Session 5: NEO discovery - A. Shugarov, B. Shustov, D. Dunham, 2021, “System of observations of daytime asteroids (SODA).” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/61bff2d8da3742f09b62179b16367b4c - S. Urakawa, K. Sugiura, N. Maeda, et al., 2021, “Development of asteroid detection application ‘COIAS’ for the Subaru HSC data.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/8df1a37de28844c2a10b72174f5a98f5 - F. Bernardi, 2021, “New NEODys tools for the EU funded NEOROCKS project: observations support and priority lists.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/53cfc16988be49869ecaa3b5124a9fe8 - L. Conversi, R. Koschny, D. Föhring, et al., 2021, “ESA PDO observing network.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/4e78ba52fd09400cbae5a881016e10dc - I. Molotov, L. Elenin, Y. Krugly, 2021, “Asteroid survey and follow up observations with small telescopes in framework of ISON network.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/c69f4782c54445a4828d79889a1fccfd - L. Jones, S. Eggl, M. Jurić, Ž. Ivezić 2021, “Discovering and characterizing Near Earth Objects with Vera C. Rubin Observatory’s Legacy Survey of Space and Time (LSST).” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/99625ad9759549c786d71debc677a370 - A. Mainzer, NEO Surveyor Investigation Team, 2021, “NEO detection, and the future of Planetary Defense.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/f79431602ce24fdf8199f33b58a3c06d

	- F. Spoto, M. Payne, M. Holman, P. Vereš, 2021, “The new MPC Confirmation Page: improvements and results.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/36c635b219b84244af3f8522112d5adb - R. Weryk, R. Wainscoat, P. Vereš, 2021, “NEOs in the isolated tracklet file.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/df7f7357faa94da382d48a7d3f1a222b - M. Keley, D. Darg, J.G. Bauer, 2021, “CATCHing Near-Earth Objects in archival survey data.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/d53d5f4dd2e84bb1b645e344c178ee86 Session 6: NEO characterization - P. Pravec, P. Scheiricha, D.J. Scheeres, et al., 2021, “Photometric observations of the unrelaxed binary Near-Earth Asteroid (35107) 1991 VH in support of the NASA Janus space mission – detection of a spin-orbit interaction.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/1bd11fd7a0ba4e2f8435d7b250fbd7bf - J. de León, J. Licandro, M. Popescu, et al., 2021, “Characterization of NEAs in the frame of NHATS program using the 10.4 m Gran Telescopio Canaria.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/30be03d123f742b09e60bae7dd8fac27 - M. Fenucci, B. Novaković, D. Vokrouhlický, R.J. Weryk, 2021, “The low thermal conductivity of the super-fast rotator (499998) 2011 PT.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/af3c7a84fee7422d9814be8f8b4e89de - A. Sergeev, B. Carry, 2021, “Photometry of hundreds of NEO’s from SDSS.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/e59101b8bd65491792c5fae3a34e37c1 - N. Moskovitz, M. Devogèle, A. Gustafsson, 2021, “Planetary Defense capabilities of the 4.3m Lowell Discovery Telescope (LDT).” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/7e37af4209a9496e99ee19e2cd2fd47c - J. Masiero, A. Mainzer, J.M. Bauer, et al., 2021, “Characterization of near-Earth asteroids from NEOWISE survey data.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/593fa3f532c04a1e9c58fdca9563e3cd - M. Devogèle, N. Moskovitz, 2021, “Polarimetry as a tool for the physical characterization of potentially hazardous asteroids.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/3aedf97c5b26499f8686a2be8a63ee7a - V. Reddy, 2021, “Challenges in differentiating NEO’s and rocket

	bodies: 2020 SO study.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/f9eb9fc4b536496e8026c1f8750d903a - D.W. Dunham, J.B. Dunham, M. Buie, et al., 2021, “Accurate NEO orbits from occultation observations.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/ea9efb409a864420b5dea30fa43b01b0 - J. Roa Vicens, D. Farnocchia, S.R. Chesley, 2021, “A new method for asteroid impact monitoring and hazard assessment.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/eb160d93589f41b0a23c52ced450107b EXERCISE SESSION: Update on space-based mitigation options EXERCISE: INJECT #2. Update on threat region Day 3, Thursday, 29 April 2021 Session 7: Deflection & disruption testing - S. Raducan, J. Ormö, M.I. Herreros, et al., 2021, “Cratering processes on rubble-pile asteroids: insights from laboratory experiments and numerical models.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/96458bda681f4d5688e9e3691b6f4fdc - R. Luther, S.D. Raducan, M. Jutzi, et al., 2021, “Kinetic impactor technique: benchmark and validation studies with iSALE and SPH.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/e4e9c12dde24409d862a3e612f7bd031 - R. Nakano, M. Hirabayashi, 2021, “NASA Double Asteroid Redirection Test: orbital perturbation by the ejecta-collision driven reshaping of Didymos after the impact event.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/0c35ed498293487e805cc9bf86d92639 - P. King, M. Bruck Syal, D.S.P. Dearborn, et al., 2021, “Late-time nuclear disruption in the PDC 2021 scenario.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/f4fb7a06a0eb41419c118c7c1ac1f79a - N.A. Gentile, 2021, “An overview of numerical radiation transport techniques in asteroid deflection modeling.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/677f15e012ee4c13945763a72db3a159 - M. Burkey, R. Managan, K. Howley, 2021, “Progress on developing a simplified model of X-ray energy disposition for nuclear mitigation missions.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/2901d2a20d73442db4f1c87b3111ee65 - A.M. Stickle, M. Bruck Syal, W.K. Caldwell, et al., 2021, “The Double Asteroid Redirection Test (DART) Impact Modeling Working Group Inverse Test.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/2901d2a20d73442db4f1c87b3111ee65

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	- S. Sonnett, A. Mainzer, T. Grav, et al., 2021 “NEO Surveyor cadence and simulations.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/a5bbb816373143f2ab26b79ffba91268 - B. Barbee, B. Benson, P. Chodas, et al., “Risk-informed spacecraft mission design for the 2021 PDC hypothetical asteroid impact scenario.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/4be503d216474a9cbbdb50c3039e0264 - J. Bell, L. Papsider, 2021, “The MILO Space Science Institute: enabling new, science-focussed deep space SmallSat missions to Near Earth Objects.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/d45a5bb88eeb43d4a6bc549f0ce0f4fe EXERCISE: INJECT #3. Updated threat corridor & detailed overview of consequences EXERCISE: Final impact area Day 4: Friday, 30 April 2021 Session 9: Impact effects - A. Losiak, C. Belcher, J. Plado, et al., 2021, “Environnemental effects of very small crater formation.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/f9d6acfe915441a39da854e10cf8ad48 - S. Haihao, L. Yue, D. Leining, et al., 2021, “The melting ablation analysis of meteorite in high temperature flow.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/fc5744be62544232b4fbc66b08eb4c0c - S. Liu, L. Sen, D. Leiling, Z. Zhigang “Numerical analysis of aerodynamic heating on asteroid during entry to Earth’s atmosphere.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/ce87d313a5194e6db506fa25842c8162 - D.O. Glazachev, O.P. Popova, V.V. Svetsov, et al., “Impact Effects Calculator. Shock wave effects from impacts of cosmic objects with diameter from a few meters to 3 km.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/f04bcc396f6d4882ad6fb460e80166e8 - O. Popova, V. Svetsov, V. Shuvalov, et al., 2021, “Impact Effects Calculator. Radiation and some other effects.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/c83dfd5cc9284e0eb389a70145e2b43c - J. Pearl, C. Raskin, M. Owen, 2021, “SPH simulation of bolide entry.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/ee63d76761e541bb9af5407427177b83 - M.J. Berger, R.J. LeVeque, 2021, “Towards adaptive simulation of

	dispersive tsunami propagation from an asteroid impact.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/4da3efe1afb44e4583be085bc0c12a40 - T.N. Titus, D. Robertson, J. Sankey, L. Mastin, 2021, “Asteroid impacts – downwind and downstream effects.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/d53e1199597b4a10b56dd822dbc8258b - C. Berk Senel, O. Temel, O. Karatekin, 2021, “Environmental consequences of asteroid impacts by General Circulation Model (GCM) simulations.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/37afa538e63d4f288b10e1de0014bdcd - J. Dotson, L. Wheeler, C. Rumpf, D. Mathias, 2021, “Bayesian inference of asteroid physical properties: application to impact scenarios.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/1bec84807d554520b62bfaf1a5cec50c Session 10: Disaster management - D.C. Chandola, 2021, “Key aspects of disaster management.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/489cd7c11986447a9751502faa468fa1 - J. Lim, 2021, “The decision to act – a human rights based approach to disaster management and response.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/9178be4934d04c90ae972effbe9c43c2 - A. Marwah, A. Grover, 2021, “Prevention, mitigation and preparedness for disaster: Role of UN-COPUOS in disaster management and Indian progress.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/a3e513c215654c75b450a4ced2146a74 - A.L. Pegetti, G. F. Perroni da Silva, M.C. Neyra Belderrain, 2021, “Communication protocol on PHO for disaster management by legitimate Brazilian institutions.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/a38a7d9407a24119a43d1cf7bd49da1a - J. Venkataramaiah, 2021, “Real-time community enabling to care for planetary disaster risk reduction.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/762b080c6aed46c4be25113bfb4b4c55 - R. Albrecht, M.H.I. Dore, 2021, “Towards plans for mitigating possible socio-economic effects due to a physical impact of an asteroid on Earth.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/695a5479f74b460cace9258621a5a2b2 - T. Kohout, S. Turunen, 2021, “Rapid evacuation of the Viipuri (Vyborg) city – Experience from the Finnish winter war 1939-1941.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/9adf5318ff7b4519b753886329a2e34f

	Day 5, Friday, 30 April 2021 Session 11: The decision to act - L.Vaz Ferreira, 2021, “Liability exoneration and Planetary Defense.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/c0d8cb0f7b4d44f19cd02d7fcc0606b3 - K. Niewęglowski, 2021, “Obligation to participate in Planetary Defense action as part of international <i>jus cogens</i>.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/96422aa3f56f42a192d423d341903d5c - A-S. Martin, 2021, “Reacting to Near-Earth Object impact: exceptional circumstances justifying non-compliance with international law.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/4752b4160de64cbca40f4408dc9293ee - A. Melamed, 2021, “Planetary Defense as entrepreneurial politics.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/ad38ceae71b1465dbcf0fe5903383dbd - A.J.Haddaji, 2021, “Understanding the social-anthropological aspects of an asteroid impact threat response from transdisciplinary lessons learned in natural disaster management.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/51258bb58c0c4b688bcb2277530e6a5b - A. Boley, M. Byers, 2021, “Precautionary Planetary Defence.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/5e1d3758b20c47c7b8b25181333b2419 - D. Koschny, ESA Planetary Defence Team, “ESA’s activities in Planetary Defence.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/ca5fd4039c234cfd8c7ae745d95da405 - G. Drolshagen, R. Kofler, D. Koschny, 2021, “Scope, objectives and first results of the Space Mission Planning Advisory Group (SMPAG).” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/bdfa2e645c9b4dd8bd271f98e74a9c42 Session 12: Public education & communication - N. Melamed, L. McGinley, M. Maynard, 2021, “Teaming up for asteroid deflection.” See: https://www.youtube.com/watch?v=sQao8HwWcqc https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/43b49f1de73548139c19e88d6a7e0259 - A. Nath, A. Nath, 2021, “Aiming for Apophis: how we did asteroid astrometry and taught others during COVID-19 lockdowns.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/3a61685c23884c08bbd5185c6c9badb6 - J. L. Cano, G. Valletta, D. Oliviero, G. Fasano, R. Opromolla, M. Micheli, D. Koschny, 2021, “Evaluation of an NEO close approach

	frequency index for public/media release purposes.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/7614f0aa69a94cbaacb129669dc3f54e - S. Srivastava, 2021, “Role of Space Generation Advisory Council (SGAC) in global Planetary Defense outreach.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/3bcbc36f8466434fa7312353d7e1d095 - A. Karl, “Engaging the audience – what can we learn from them?” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/bcdbe86256964cc281f7aee7935cfda3 - S. Schmalz, F. Graziani, R. di Roberto, V. Voropaev, 2021, “Observations of NEAs and national public outreach at the Astronomical Observatory of Castelgrande (Italy).” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/688a87a4e8fe4f7282066a763d75b75a - C. Nugent, L. Billings, 2021, “Public communication in the case of impending impact. Lessons from the Covid-19 pandemic.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/1f9742fff3564e32b33b6e6997ef866e Session 13: Apophis and others, far and near: future characterization opportunities from NEO close approaches - M. Granvik, Morbidelly, Jedicke, et al., 2021, “Frequency of close Earth approaches by Near Earth Objects.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/02516d641e444c06812fb5a650f0ac66 - M. Kelley, V. Reddy, D.Farnocchia, et al., 2021, “International Asteroid Warning Network (IAWN) Apophis Campaign.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/64851a6caad54fbbb59e7724f7f89bc4 - D.J. Tholen, D. Farnocchia, 2021, “Detection of Yarkovsky acceleration of (99942) Apophis.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/374fb0c00e144047b962896fc6cc7f2f - J.-Y. Prado, D. Hestroffer, A. Herique, 2021, “Apophis Express, a unique opportunity for visiting Apophis in 2029.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/862c33b687964022a9f8341c5ed0c453 - P.A. Taylor, E.L. Wright, J.R. Masiero, et al., 2021, “Characterization of Near-Earth Asteroid 153814 (2001 WN5) and prospects for the 2028 close encounter with Earth.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/eed068f68aad40c7b789d580018dc659 - N.A. Eismont, M.V. Pupkov, K.S. Fedyaev, V.A. Zubko, 2021, “Extension of the Earth libration point missions by targeting a spacecraft to Near-Earth Asteroids.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/4145e7acdde3422cab38c2ba77edb4be

	PANEL: PROPOSAL: INTERNATIONAL YEAR OF PLANETARY DEFENSE. The conference included a hypothetical NEO/Earth impact event scenario as part of the conference (similar to what was done at the 2013, 2015, 2017 & 2019 PDCs): 2021 PDC Hypothetical Asteroid Impact Scenario. See: https://cneos.jpl.nasa.gov/pd/cs/pdc21/ https://cneos.jpl.nasa.gov/nda/nda.html https://www.jpl.nasa.gov/news/nasa-to-participate-in-tabletop-exercise-simulating-asteroid-impact See also: https://www.esa.int/Safety_Security/Lessons_learned_from_simulated_strike https://cneos.jpl.nasa.gov/pd/cs/ https://cneos.jpl.nasa.gov/pd/cs/pdc21/ https://www.space.com/planetary-defense-asteroid-impact-scenario-exercise-2021?utm_source=notification Miscellaneous: A. Falke, K. Atkinson, Marc Chapuy, 2021, IAA-PDC-21-08-12, “Hijacking a satellite for short-warning asteroid deflection – FastKD mission, design and implementation.” See: https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/6c44079b35844ddfa7df966c97ec0a16 https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/8195e7b8bd394ac6bde779211787ebac
2021, Apr 27	Anon, 2021, <i>ESA Safety & Security, PD</i>, 27 April 2021, “New ESA telescope [Test-Bed Telescope 2] in South America to search for asteroids.” See: https://www.esa.int/Safety_Security/Planetary_Defence/New_ESA_telescope_in_South_America_to_search_for_asteroids See also: https://www.eso.org/public/unitedkingdom/news/eso2107/
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2021, Apr 29	M.M. Al Asad, L.C. Philpott ¹ , C.L. Johnson, et al., 2021, <i>Planetary Science Journal</i> , 2, 82, “Validation of stereophotoclinometric shape models of asteroid (101955) Bennu during the OSIRIS-REx mission.” See: https://ui.adsabs.harvard.edu/abs/2021PSJ.....2...82A/abstract
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2021, May	P. Abell, C. Raymond, T. Daly, et al., 2021, <i>Bulletin of the American Astronomical Society</i> , 53, 270, Planetary Science and Astrobiology Decadal Survey 2023-2032 white paper e-id. 270, “Near-Earth Object characterization priorities and considerations for Planetary Defense.” See: https://ui.adsabs.harvard.edu/abs/2021BAAS...53d.270A/abstract
2021, May	D. Adamo, P.A. Abell, R.C. Anderson, et al., 2021, <i>Bulletin of the American Astronomical Society</i> , 53, 043, Planetary Science and Astrobiology Decadal Survey 2023-2032 white paper e-id. 043, “Near-Earth Object exploration leading to human visits.” See: https://ui.adsabs.harvard.edu/abs/2021BAAS...53d.043A/abstract
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2021, May	B. Barbee, P.A. Abell, R.P. Binzel, et al., 2021, <i>Bulletin of the American Astronomical Society</i> , 53, 117, Planetary Science and Astrobiology Decadal Survey 2023-2032 white paper e-id. 117, “Future spacecraft missions for Planetary Defense preparation.” See: https://ui.adsabs.harvard.edu/abs/2021BAAS...53d.117B/abstract
2021, May	R. Binzel, B.W. Barbee, O.S. Barnouin, et al., 2021, <i>Bulletin of the American Astronomical Society</i> , 53, 045, Planetary Science and

	Astrobiology Decadal Survey 2023-2032 white paper e-id. 045, “Apophis 2029: decadal opportunity for the science of Planetary Defense.” See: https://ui.adsabs.harvard.edu/abs/2021BAAS...53d.045B/abstract
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2021, May 4, 12:14	Apollo NEA 2021 AF8 ($H = 20.1$ mag, $D \approx 300$ m, PHA) passed Earth at a nominal miss distance of 8.74 LD. Minimum miss distance 8.74 LD. See: 2021 AF8 – S2P , 2021 AF8 - JPL Discovery station: Mt. Lemmon Survey See also: https://www.minorplanetcenter.net/mpec/K21/K21AE4.html https://www.spacereference.org/asteroid/2021-af8
2021, May 4, 21:29	Apollo NEA 2021 JV ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.36 LD. Minimum miss distance 0.36 LD. [2021-53] See: 2021 JV – S2P , 2021 JV - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2021, May 5	ESA NEOCC Newsletter. May 2021. See: http://neo.ssa.esa.int/newsletters [May 2021] http://neo.ssa.esa.int/neo-cc-riddles https://neo.ssa.esa.int/documents/20126/0/Newsletter+May+2021.pdf/
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2021, May 8	Aten NEA 2021 JQ2 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.17 LD. Minimum miss distance 0.17 LD. [2021-55] See: 2021 JQ2 – S2P , 2021 JQ2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 8 May 2076.
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2021, May 14	Apollo NEA 2021 JU6 ($H = 27.4$ mag, $D \approx 12$ m) passed Earth at a nominal miss distance of 0.17 LD. Minimum miss distance 0.17 LD. [2021-57] See: 2021 JU6 – S2P , 2021 JU6 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
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2021, May 30	Aten NEA 2021 KO2 ($H = 28.1$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.96 LD. [2021-59] See: 2021 KO2 – S2P , 2021 KO2 - JPL Discovery station: Tokyo-Kiso See: http://iawn.net/ See also: 30 May 2022.
2021, May 31, 02:1	Apollo NEA 2021 KN2 ($H = 27.7$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.38 LD. [2021-60] See: 2021 KN2 – S2P , 2021 KN2 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2021, May 31, 05:4	Aten NEA 2021 KQ2 ($H = 30.0$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.46 LD. Minimum miss distance 0.46 LD. [2021-61] See: 2021 KQ2 – S2P , 2021 KQ2 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
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2021, Jun 1	Anon., 2021, <i>ESA Safety & Security</i> , 1 June 2021, “The incredible adventures of the Hera mission – presenting Hera .” See: https://www.esa.int/Safety_Security/Hera/The_Incredible_Adventures_of_the_Hera_mission_Presenting_Hera
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2021, Jun 1, 17:05	Aten NEA 2018 LB , $H = 26.0$ mag, $D \approx 22$ m) will pass Earth at a nominal miss distance of 2.90 LD. Minimum miss distance 0.91 LD. See: 2018 LB - SSA , 2018 LB - JPL
2021, Jun 1, 22:44	Apollo NEA 2021 KT2 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a

	nominal miss distance of 0.76 LD. Minimum miss distance 0.75 LD. [2021-62] See: 2021 KT2 – S2P , 2021 KT2 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
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2021, Jun 4	Apollo NEA 2021 LX1 ($H = 27.1$ mag, $D \approx 14$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.41 LD. [2021-63] See: 2021 LX1 – S2P , 2021 LX1 – JPL Discovery station: ATLAS-HKO See: http://iawn.net/
2021, Jun 5	ESA NEOCC Newsletter . June 2021. See: http://neo.ssa.esa.int/newsletters [June 2021] http://neo.ssa.esa.int/neo-cc-riddles https://neo.ssa.esa.int/documents/20126/0/Newsletter+June+2021.pdf/
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	reveal-origins-life-on-earth/ See also: https://www.space.com/rare-carbonaceous-carbonate-meteorite-found
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2021, Aug 2	Apollo NEA 2021 PC ($H = 26.8$ mag, $D \approx 16$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2021-72]

	See: 2021 PC – S2P , 2021 PC – JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
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2021, Sep 9, 00:43	Aten NEA 2021 RQ2 ($H = 29.5$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.49 LD. [2021-84] See: 2021 RQ2 – S2P , 2021 RQ2 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 8 Sep 1969.

2021, Sep 9, 16:16	Apollo NEA 2021 RB6 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.67 LD. Minimum miss distance 0.67 LD. [2021-85] See: 2021 RB6 – S2P , 2021 RB6 - JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2021, Sep 11, 15:31	Apollo NEA 2021 RG6 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.22 LD. Minimum miss distance 0.22 LD. [2021-86] See: 2021 RG6 – S2P , 2021 RG6 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2021, Sep 11, 18:47	Apollo NEA 2021 RG12 ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.84 LD. Minimum miss distance 0.84 LD. [2021-87] See: 2021 RG12 – S2P , 2021 RG12 - JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
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2021, Sep 12	Apollo NEA 2021 RR5 ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.20 LD. Minimum miss distance 0.20 LD. [2021-88] See: 2021 RR5 – S2P , 2021 RR5 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 10 Sep 2064.
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2021, Sep 14	H.-C. Lim, K.-P. Sung, M. Choi, et al., 2021, <i>Journal of Astronomy and Space Sciences</i> , 38, 165, “Evaluation of a laser altimeter using the pseudo-random noise modulation technique for Apophis mission.” See: https://ui.adsabs.harvard.edu/abs/2021JASS...38..165L/abstract
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2021, Sep 16, 09:19	Apollo NEA 2021 RF16 ($H = 29.0$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.83 LD. Minimum miss distance 0.83 LD. [2021-89] See: 2021 RF16 – S2P , 2021 RF16 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2021, Sep 16, 20:28	Apollo NEA 2021 SG ($H = 24.0$ mag, $D \approx 60$ m) passed Earth at a nominal miss distance of 0.64 LD. Minimum miss distance 0.64 LD. [2021-90] See: 2021 SG – S2P , 2021 SG - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
2021, Sep 17	Apollo NEA 2021 SP ($H = 29.2$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.0367 LD (= 2.21 R_{Earth} from the geocenter). Minimum miss distance 0.0365 LD (= 2.20 R_{Earth} from the geocenter). [2021-91] See: 2021 SP – S2P , 2021 SP - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
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2021, Sep 20	Apollo NEA 2021 SQ ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.71 LD. [2021-92] See: 2021 – SQ S2P , 2021 – SQ JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
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2021, Sep 22	Apollo NEA 2021 NY1 ($H = 21.5$ mag, $D \approx 170$ m, PHA) passed Earth at a nominal miss distance of 3.90 LD. Minimum miss distance 3.90 LD. See: 2021 NY1 – S2P , 2021 NY1 – JPL Discovery station: Pan-STARRS 1, Haleakala See also: https://theskylive.com/2021ny1-info https://theskylive.com/will-asteroid-2021ny1-impact-earth
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2021, Sep 27	Apollo NEA 2021 SQ1 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.43 LD. Minimum miss distance 0.43 LD. [2021-94] See: 2021 SQ1 S2P , 2021 SQ1 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2021, Sep 29	M.J. Berger, R.J. LeVeque, 2021, submitted to Proc. International Congress of Mathematicians, 2022, e-print <i>arXiv:2110.01420</i>, “Towards adaptive simulations of dispersive tsunami propagation from an asteroid impact.” See: https://ui.adsabs.harvard.edu/abs/2021arXiv211001420B/abstract
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2021, Oct 3, 04:05	Apollo NEA 2021 TV1 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.42 LD. Minimum miss distance 0.42 LD. [2021-97] See: 2021 TV1 – S2P , 2021 TV1 – JPL Discovery station: ATLAS-MLO, Mauna Loa See: http://iawn.net/
2021, Oct 3, 21:41	Apollo NEA 2021 TG1 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.76 LD. Minimum miss distance 0.76 LD. [2021-98] See: 2021 TG1 – S2P , 2021 TG1 – JPL Discovery station: Catalina Sky Survey See: http://iawn.net/
2021, Oct 5	E. Tatsumi, N. Sakatani, [...] S. Sugita, 2021, <i>Nature</i>

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2021, Oct 6	ESA NEOCC Newsletter. October 2021. See: http://neo.ssa.esa.int/newsletters [September 2021] https://neo.ssa.esa.int/documents/20126/0/Newsletter+October+2021.pdf/
2021, Oct 6	Apollo NEA 2021 TQ4 ($H = 29.9$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2021-99] See: 2021 TQ4 – S2P , 2021 TQ4 - JPL Discovery station: Tokyo-Kiso See: http://iawn.net/ See also: 7 Oct 2061.
2021, Oct 7	Apollo NEA 2015 TQ21 ($H = 27.6$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 7.79 LD. Minimum miss distance 0.89 LD. See: 2015 TQ21 - SSA , 2015 TQ21 - JPL See also: 7 Oct 2015, 6 Oct 2092.
2021, Oct 8	D. Seligman, W.G. Levine, S.H.C. Cabot, et al., 2012, <i>Astrophysical Journal</i>, 920, 28, “On the spin dynamics of elongated minor bodies with applications to a possible solar system analogue composition for ‘Oumuamua.” See: https://ui.adsabs.harvard.edu/abs/2021ApJ...920...28S/abstract
2021, Oct 9	Y. Ketema, 2021, submitted to <i>Journal of Guidance, Control, and Dynamics</i>, e-print <i>arXiv:2110.04631</i>, “A mass-optimized Gravity Tractor for asteroid deflection.” See: https://ui.adsabs.harvard.edu/abs/2021arXiv211004631K/abstract
2021, Oct 10	Apollo NEA 2021 TT1 ($H = 26.3$ mag, $D \approx 20$ m) passed Earth at a nominal miss distance of 0.97 LD. Minimum miss distance 0.97 LD. [2021-100] See: 2021 TT1 – S2P , 2021 TT1 – JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/
2021, Oct 11	Anon., 2021, <i>ESA / Safety & Security / Planetary Defence</i>, 11 October 2021, “Scaling up ESA’s asteroid facilities.” See: https://www.esa.int/Safety_Security/Planetary_Defence/Scaling_up_ESA_s_asteroid_facilities
2021, Oct 11, 01:21	Apollo NEA 2021 TK11 ($H = 28.7$ mag, $D \approx 7$ m) passed Earth at a

	nominal miss distance of 0.35 LD. Minimum miss distance 0.35 LD. [2021-101] See: 2021 TK11 – S2P , 2021 TK11 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2021, Oct 11, 03:17	Apollo NEA 2021 TT13 ($H = 29.8$ mag, $D \approx 4$ m) passed Earth at a nominal miss distance of 0.14 LD. Minimum miss distance 0.14 LD. [2021-102] See: 2021 TT13 – S2P , 2021 TT13 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/
2021, Oct 11, 05:59	Apollo NEA 2021 TH15 ($H = 28.9$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.82 LD. [2021-103] See: 2021 TH15 – S2P , 2021 TH15 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/
2021, Oct 12	N. Liu, J. Barosch, L.R. Nittler, et al., 2021, <i>Astrophysical Journal Letters</i> , 920, L26, “New multielement isotopic compositions of presolar SiC grains: implications for their stellar origins.” See: https://iopscience.iop.org/article/10.3847/2041-8213/ac260b See also: https://www.space.com/ancient-meteorites-grains-clues-about-carbon-stars
2021, Oct 12	Apollo NEA 2021 TE13 ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.0701 LD (= 4.23 R_{Earth} from the geocenter). Minimum miss distance 0.0701 LD. [2021-104] See: 2021 TE13 – S2P , 2021 TE13 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/ See also: 13 Oct 2085.
2021, Oct 13-14	17th Meeting Space Mission Planning Advisory Group (SMPAG) , 13-14 Oct 2021, WebEx virtual meeting. See: https://www.cosmos.esa.int/web/smpag/ https://www.cosmos.esa.int/web/smpag/meeting-16-mar-2021-
2021, Oct 14	J. Hong, R.P. Binzel, B. Allen, et al., 2021, <i>Space Science Reviews</i> , in press, e-print <i>arXiv:2110.07690</i> , “Calibration and performance of the REgolith X-Ray Imaging Spectrometer (REXIS) aboard NASA's OSIRIS-REx mission to Bennu .” See: https://ui.adsabs.harvard.edu/abs/2021arXiv211007690H/abstract

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2021, Oct 14	Apollo NEA 2021 TM14 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.38 LD. Minimum miss distance 0.38 LD. [2021-105] See: 2021 TM14 – S2P , 2021 TM14 - JPL Discovery station: ATLAS-HKO, Haleakala See: http://iawn.net/ See also: 15 Oct 2050 .
2021, Oct 15	C.Q. Choi, 2021, <i>Space.com</i> , 15 October 2021, “Asteroids: fun facts and information about asteroids.” See: https://www.space.com/51-asteroids-formation-discovery-and-exploration.html
2021, Oct 15	A.H. Fernandes Guimarães, S. Aljbaae, A.F. Bertachini de Almeida Prado, 2021, <i>Planetary and Space Science</i> , 206, 105305, “The opportune location for a kinetic impactor to disrupt potentially hazardous asteroids .” See: https://ui.adsabs.harvard.edu/abs/2021P%26SS..20605305F/abstract
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2021, Oct 15	K.F. Navarro, J. Urrutia-Fucugauchi, M. Villagran-Muniz, et al., 2021, <i>Planetary and Space Science</i> , 206, 10531., “Physical characterization of a simulated impact-vapor plume using laser ablation of Chicxulub sediments.” See: https://ui.adsabs.harvard.edu/abs/2021P%26SS..20605311N/abstract
2021, Oct 16, 12:13	Apollo NEA 2021 UL ($H = 30.3$ mag, $D \approx 3$ m) passed Earth at a nominal miss distance of 0.0934 LD (= 5.64 R_{Earth} from the geocenter) . Minimum miss distance 0.0934 LD . [2021-106] See: 2021 UL – S2P , 2021 UL – JPL Discovery station: Pan-STARRS 2, Haleakala See: http://iawn.net/ See also: 17 Oct 2068 .
2021, Oct 16, 13:38	Apollo NEA 2021 TJ15 ($H = 28.4$ mag, $D \approx 7$ m) passed Earth at a

	nominal miss distance of 1.0002 LD. Minimum miss distance 0.9963 LD. See: 2021 TJ15 – S2P , 2021 TJ15 - JPL
2021, Oct 18	Anon, 2021, <i>Sky & Telescope</i> , “ Jupiter whacked again? Japanese astronomers record possible impact.” See: https://skyandtelescope.org/astronomy-news/jupiter-whacked-again-japanese-astronomers-record-possible-impact/ See also: https://www.space.com/jupiter-impact-flash-october-2021-photo-video
2021, Oct 18	Apollo NEA 2021 TG14 ($H = 28.2$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2021-107] See: 2021 TG14 – S2P , 2021 TG14 - JPL Discovery station: Pan-STARRS 1, Haleakala See: http://iawn.net/ See also: 15 Apr 1969, 15 Apr 1978. https://www.space.com/asteroid-2021-tg14-flyby-earth
2021, Oct 20	K. Fast, 20 October, 2021, “What if an asteroid were going to hit Earth? ” See: https://www.youtube.com/watch?v=NwSISlnoy9w
2021, Oct 20	Apollo NEA 1996 VB3 ($H = 22.0$ mag, $D \approx 140$ m) passed Earth at a nominal miss distance of 8.75 LD. Minimum miss distance 8.75 LD. See: 1996 VB3 – S2P , 1996 VB3 – JPL
2021, Oct 21	S. Cambioni, M. Delbo, G. Poggiali, et al., 2021, <i>Nature</i> , 598, 49, “Fine-regolith production on asteroids controlled by rock porosity.” See: https://www.nature.com/articles/s41586-021-03816-5 See also: https://news.arizona.edu/story/highly-porous-rocks-responsible-bennus-surprisingly-craggy-surface https://www.nasa.gov/feature/goddard/2021/nasa-mission-helps-solve-a-mystery-why-are-some-asteroid-surfaces-rocky
2021, Oct 23	N. Myhrvold, P. Pinchuk, J.-L. Margot, 2021, <i>Planetary Science Journal</i> , in press, e-print <i>arXiv:2110.12098</i> , “Analysis of four-band WISE observations of asteroids.” See: https://ui.adsabs.harvard.edu/abs/2021arXiv211012098M/abstract
2021, Oct 24	Apollo NEA 2021 UT ($H = 29.3$ mag, $D \approx 5$ m) passed Earth at a nominal miss distance of 0.39 LD. Minimum miss distance 0.39 LD. [2021-108] See: 2021 UT – S2P , 2021 UT - JPL Discovery station: GINOP-KHK, Piszkesteto

	See: http://iawn.net/
2021, Oct 25, 01:55	Aten NEA 2021 UO1 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.40 LD. Minimum miss distance 0.39 LD. [2021-109] See: 2021 UO1 – S2P , 2021 UO1 - JPL Discovery station: ... See: http://iawn.net/ See also: 4 Oct 1922, 25 Oct 2029.
2021, Oct 25, 03:07	Apollo/Aten NEA 2021 UA1 ($H = 31.8$ mag, $D \approx 1.5$ m) passed Earth at a nominal miss distance of 0.0234 LD (= 1.41 R_{Earth} from the geocenter). Minimum miss distance 0.0234 LD. [2021-110] See: 2021 UA1 – S2P , 2021 UA1 - JPL Discovery station: Palomar Mountain--ZTF See: http://iawn.net/
2021, Oct 27	Apollo NEA 2021 UH1 ($H = 31.7$ mag, $D \approx 1.7$ m) passed Earth at a nominal miss distance of 0.19 LD. Minimum miss distance 0.19 LD. [2021-111] See: 2021 UH1 – S2P , 2021 UH1 - JPL Discovery station: Mt. Lemmon Survey See: http://iawn.net/
2021, Oct 29	E. Howell, 2021, <i>Space.com</i> , 29 October 2021, “What would happen if an asteroid were going to hit Earth ? A NASA scientist explains..” See: https://www.space.com/what-would-happen-asteroid-hit-earth-dart-video
2021, Oct 29, 01:00	Apollo NEA 2021 UV5 ($H = 28.8$ mag, $D \approx 6$ m) passed Earth at a nominal miss distance of 0.30 LD. Minimum miss distance 0.30 LD. [2021-112] See: 2021 UV5 – S2P , 2021 UV5 – JPL Discovery station: ... See: http://iawn.net/
2021, Oct 29, 12:50	Apollo NEA 2021 UT5 ($H = 28.3$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.79 LD. [2021-113] See: 2021 UT5 – S2P , 2021 UT5 – JPL Discovery station: ... See: http://iawn.net/
2021, Oct 30	D. Dobrijevic, 2021, <i>Space.com</i> , 30 October 2021, “10 Earth impact craters you must see.”

	See: https://www.space.com/10-earth-impact-craters-you-should-visit
2021, Oct 30	Apollo NEA 2021 UW1 ($H = 26.2$ mag, $D \approx 21$ m) passed Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2021-114] See: 2021 UW1 – S2P , 2021 UW1 - JPL Discovery station: ... See: http://iawn.net/
2021, Oct 31	Apollo NEA 2021 UJ6 ($H = 28.0$ mag, $D \approx 9$ m) passed Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.79 LD. [2021-115] See: 2021 UJ6 – S2P , 2021 UJ6 – JPL Discovery station: ... See: http://iawn.net/
2021, Nov	Foreseen first light of the Large Synoptic Survey Telescope (LSST), a 6.7-m effective diameter telescope with a 9.6 square degree field and a 3.2 gigapixel camera, under development since 2000, to scan the sky from Cerro Pachón (northern Chile) near the Gemini South and Southern Astrophysical Research (SOAR) telescopes. Taking more than 800 panoramic images each night, it can cover the accessible sky twice a week. Limiting magnitude: $v = 24.5$ mag. The planned LSST baseline survey will be capable of providing orbits for 82% of PHAs with $D > 140$ m after ~ 10 yr of operation, and 90% complete for objects with $D > 230$ m. During its 10-year survey, LSST will produce 30 terabytes of raw astronomical data each night, resulting in a database catalog of 22 petabytes and an image archive of 100 petabytes. LSST is on schedule for full science operations in 2023. On 6 January 2020, LSST was renamed the Vera C. Rubin Observatory. Its first 10 years of work will be dedicated entirely to a project now known as the Legacy Survey of Space and Time. See: http://www.lsst.org/lsst Ref: - Z. Ivezić, J.A. Tyson, M. Jurić, et al., 2007, in: A. Milani, G.B. Valsecchi & D. Vokrouhlický (eds.), Proc. IAU Symp. No. 236 on <i>Near Earth Objects, our Celestial Neighbors: Opportunity and Risk</i>, Prague (Czech Republic), 14-18 August 2006 (Cambridge: CUP), p. 353, "LSST, comprehensive NEO detection, characterization, and orbits." See: http://adsabs.harvard.edu/abs/2007IAUS..236..353I - R.L. Jones, S.R. Chesley, A.J. Connolly, A.W. Harris, et al., 2009, <i>Earth, Moon, and Planets</i>, 105, 101, "Solar System Science with LSST." See: http://adsabs.harvard.edu/abs/2009EM%26P..105..101J - B. Corbin, 2010, presented at the <i>61st International Astronautical</i>

	Congress, Prague (Czech Republic), 27 September - 1 October 2010, "Implementing advanced technologies and models to reduce uncertainty in a global, cost-effective asteroid mitigation system." See: http://www.spacegeneration.org/index.php/eventstopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf See also: http://www.lsst.org/overview/overview_v1.0.pdf http://www.lsst.org/Science/docs/DRM2.pdf http://www.lsst.org/lsst/scibook http://www.lsst.org/lsst/news http://www.lsst.org/News/enews/director-201010.html http://adsabs.harvard.edu/abs/2012AAS...21915605T http://targetneo.jhuapl.edu/pdfs/sessions/TargetNEO-Session6-Jones.pdf http://www.space.com/15447-3-2-billion-pixel-camera-telescope-critical.html https://www.space.com/lsst-named-vera-rubin-observatory.html https://videos.space.com/m/zCJlubA6/nsf-vera-c-rubin-observatory-will-be-revolutionary https://b612foundation.org/how-many-asteroids-will-lsst-find-we-now-have-that-number-by-dr-ed-lu/
2021, Nov	R.-L. Ballouz, K.J. Walsh, P. Sánchez, et al., 2021, <i>Monthly Notices of the Royal Astronomical Society</i>, 507, 5087, "Modified granular impact force laws for the OSIRIS-REx touchdown on the surface of asteroid (101955) Bennu." See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.507.5087B/abstract
2021, Nov	S. Geng, B. Zhou, M. Li, 2021, <i>Monthly Notices of the Royal Astronomical Society</i>, 507, 4661, "On the capture of small stony asteroids into the Earth's orbit by atmospheric grazing." See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.507.4661G/abstract
2021, Nov	À. Jorba, B. Nicolás, 2021, <i>Communications in Nonlinear Science and Numerical Simulation</i>, 102, 105948, "Using invariant manifolds to capture an asteroid near the L3 point of the Earth-Moon bicircular model." See: https://ui.adsabs.harvard.edu/abs/2021CNSNS.10205948J/abstract
2021, Nov	P.K. King, M. Bruck Syal, D.S.P. Dearborn, et al., 2021, <i>Acta Astronautica</i>, 188, 367, "Late-time small body disruptions for planetary defense." See: https://ui.adsabs.harvard.edu/abs/2021AcAau.188..367K/abstract
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2021, Nov	F. Monteiro, E. Rondón, D. Lazzaro, et al., 2021, <i>Monthly Notices of the Royal Astronomical Society</i> , 507, 5403, “Physical characterization of equal-mass binary near-Earth asteroid 2017 YE5 : a possible dormant Jupiter -family comet.” See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.507.5403M/abstract
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2021, Nov	G.O. Ryabova, 2021, <i>Monthly Notices of the Royal Astronomical Society</i> , 507, 4481, “The Geminid meteor shower radiant: a mathematical model.” See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.507.4481R/abstract
2021, Nov	T.J. Zegmott, S.C. Lowry, A. Rožek, et al., 2021, <i>Monthly Notices of the Royal Astronomical Society</i> , 507, 4914, “Detection of the YORP effect on the contact binary (68346) 2001 KZ66 from combined radar and optical observations.” See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.507.4914Z/abstract
2021, Nov 1	S.M. Ferrone, B.E. Clark, H.H. Kaplan, et al., 2021, <i>Icarus</i> , 368, 114579, “Visible-near-infrared observations of organics and carbonates on (101955) Bennu : classification method and search for surface context.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..36814579F/abstract
2021, Nov 1	D. Nesvorný, W.F. Bottke, S. Marchi, 2021, <i>Icarus</i> , 368, 114621, “Dark primitive asteroids account for a large share of K/Pg-scale impacts on the Earth.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..36814621N/abstract See also: https://www.space.com/dinosaur-impactor-origin
2021, Nov 1	Y. Wang, M. Li, Z. Gong, et al., 2021, <i>Icarus</i> , 368, 114596, “Assembled kinetic impactor for deflecting asteroids by combining the spacecraft with the launch vehicle upper stage.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..36814596W/abstract See also:

	https://www.space.com/china-rocket-fleet-divert-asteroid-bennu
2021, Nov 9	Apollo NEA 2019 XS ($H = 23.8$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 1.49 LD. Minimum miss distance 1.49 LD. See: 2019 XS – S2P , 2019 XS – JPL The International Asteroid Warning Network (IAWN) will conduct an observational campaign in November with the goal of assessing the accuracy of the observation times reported by asteroid observers. The target of the campaign is the small asteroid 2019 XS, which will pass by Earth on 2021 November 9 at about 1.5 lunar distances. Since it will be passing so close, the asteroid will move quite rapidly across the sky during the encounter, which provides an opportunity to analyze observation timing errors. Timing inaccuracies have become an increasingly important source of error as astrometric accuracy has improved over time and the number of observed fast movers has increased. CNEOS will analyze the observational data reported to the Minor Planet Center and quantify timing errors for the observations obtained as part of the campaign led by the Planetary Data System Small Bodies Node at the University of Maryland for IAWN. See: https://cneos.jpl.nasa.gov/news/news207.html https://iawn.net/obscamp/2019XS/
2021, Nov 15	D. Farnocchia, S.R. Chesley, Y. Takahashi, et al., 2021, <i>Icarus</i>, 369, 114594, “Ephemeris and hazard assessment for near-Earth asteroid (101955) Bennu based on OSIRIS-REx data.” The most significant individual impact solution is for September 2182, with an impact probability of 1 in 2700. See: https://ui.adsabs.harvard.edu/abs/2021Icar..36914594F/abstract See also: https://www.jpl.nasa.gov/news/nasa-spacecraft-provides-insight-into-asteroid-bennus-future-orbit
2021, Nov 15	E. Mazzotta Epifani, E. Dotto, D. Perna, et al., 2021, <i>Planetary and Space Science</i>, 208, 105341, “A colour portrait of the interstellar comet 2I/Borisov.” See: https://ui.adsabs.harvard.edu/abs/2021P%26SS..20805341M/abstract
2021, Nov 15	C. Sugimoto, E. Tatsumi, Y. Cho, et al., 2021, <i>Icarus</i>, 369, 114529, “High-resolution observations of bright boulders on asteroid Ryugu: 1. Size frequency distribution and morphology.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..36914529S/abstract
2021, Nov 15	C. Sugimoto, E. Tatsumi, Y. Cho, et al., 2021, <i>Icarus</i>, 369, 114591, “High-resolution observations of bright boulders on asteroid Ryugu: 2. Spectral properties.”

	See: https://ui.adsabs.harvard.edu/abs/2021Icar..36914591S/abstract
2021, Nov 23	Anticipated launch of NASA Double Asteroid Redirection Test (DART) mission. DART is a demonstration of the kinetic impact technique to change the motion of an asteroid in space: DART is a planetary defense-driven test of one of the technologies for preventing the Earth impact of a hazardous asteroid, the kinetic impactor. DART's primary objective is to demonstrate a kinetic impact on a small asteroid. The binary near-Earth asteroid (65803) Didymos is the target for DART. While Didymos' primary body is approximately 800 meters across, its secondary body (or "moonlet") has a 150-meter size, which is more typical of the size of asteroids that could pose a more common hazard to Earth. The DART spacecraft will achieve the kinetic impact by deliberately crashing itself into the moonlet at a speed of approximately 6 km/s, with the aid of an onboard camera and sophisticated autonomous navigation software. The collision will change the speed of the moonlet in its orbit around the main body by a fraction of one percent, enough to be measured using telescopes on Earth. It will intercept Didymos' moonlet on September 2022, when the Didymos system is within 0.07 AU (11.000.000 km) of Earth, enabling observations by ground-based telescopes and planetary radar to measure the change in momentum imparted to the moonlet. See: https://www.nasa.gov/planetarydefense/dart See also: https://dart.jhuapl.edu/Mission/index.php https://www.lpi.usra.edu/sbag/meetings/jun2018/presentations/stickle.pdf https://www.cosmos.esa.int/documents/336356/336472/SMPAG_DART_Update_Johnson_2020-02-06+%281%29.pdf https://www.cosmos.esa.int/documents/336356/336472/PDCO_Brief_to_SMPAG_Johnson_2020-02-06+%281%29.pdf https://www.iau.org/news/pressreleases/detail/iau2007/?lang https://www.esa.int/Safety_Security/Hera https://www.space.com/nasa-delays-dart-asteroid-mission-launch-2022 https://www.cosmos.esa.int/documents/336356/336472/Johnson_DART-NEOSM_SMPAG_2021-03-25.pdf https://www.nasa.gov/press-release/nasa-invites-media-to-launch-of-double-asteroid-redirection-test https://www.space.com/nasa-dart-asteroid-mission-launch-date https://www.nasa.gov/feature/dart-arrives-at-vandenberg-space-force-base-its-final-stop-before-launch https://www.space.com/nasa-dart-asteroid-mission-launch-one-month https://en.wikipedia.org/wiki/Double_Asteroid_Redirection_Test https://en.wikipedia.org/wiki/65803_Didymos https://en.wikipedia.org/wiki/Dimorphos https://en.wikipedia.org/wiki/AIDA_(mission)#Hera See also: 23 June 2020.

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2021, Dec	T. Arai, T. Okada, S. Tanaka, et al., 2021, <i>Earth, Planets and Space</i>, 73, 115, “Geometric correction for thermographic images of asteroid 162173 Ryugu by TIR (thermal infrared imager) onboard Hayabusa2.” See: https://ui.adsabs.harvard.edu/abs/2021EP%26S...73..115A/abstract
2021, Dec	A. Hibberd, N. Perakis, A.M.Hein, 2021, <i>Acta Astronautica</i>, 189, 584, “Sending a spacecraft to interstellar comet 2I/Borisov.” See: https://ui.adsabs.harvard.edu/abs/2021AcAau.189..584H/abstract
2021, Dec	T. Mills, P.G. Brown, M.J. Mazur, et al., 2021, <i>Monthly Notices of the Royal Astronomical Society</i>, 508, 3684, “Iron rain: measuring the occurrence rate and origin of small iron meteoroids at Earth.” See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.508.3684M/abstract
2021, Dec	M. Tan, K. Zhan, J. Wang, 2021, <i>Acta Astronautica</i>, 189, 181, “Strategies to capture asteroids to distant retrograde orbits in the Sun-Earth system.” See: https://ui.adsabs.harvard.edu/abs/2021AcAau.189..181T/abstract
2021, Dec	E. Tatsumi, M. Popescu, H. Campins, et al., 2021, <i>Monthly Notices of the Royal Astronomical Society</i>, 508, 2053, “Widely distributed exogenic materials of varying compositions and morphologies on asteroid (101955) Bennu.” See: https://ui.adsabs.harvard.edu/abs/2021MNRAS.508.2053T/abstract
2021, Dec	P. Tricarico, D.J. Scheeres, A.S. French, et al., 2021, <i>Icarus</i>, 370, 114665, “Internal rubble properties of asteroid (101955) Bennu.” See: https://ui.adsabs.harvard.edu/abs/2021Icar..37014665T/abstract
2021, Dec 11	Apollo NEA 4660 Nereus (1982 DB, $H = 18.5$ mag, $D \approx 510 \times 330 \times 240$ m, PHA) will pass Earth at 10.2 LD. Minimum miss distance 10.2 LD. See: 4660 Nereus - SSA , 1982 DB - JPL Ref: - M. Brozovic, S.J. Ostro, L.A.M. Benner, et al., 2009, <i>Icarus</i>, 201, 153, "Radar observations and a physical model of asteroid 4660 Nereus, a prime space mission target." See: http://adsabs.harvard.edu/abs/2009Icar..201..153B See also: http://en.wikipedia.org/wiki/4660_Nereus

	See also: 29 Jan 1900, 22 Jan 2002, 14 Feb 2060, 4 Feb 2071, 23 Dec 2112, 4 Feb 2166.
2021, Dec 18	Anticipated launch of the James Webb Space Telescope. First scientific data becoming available 6 months after launch. See: https://www.nasa.gov/webb https://content.govdelivery.com/accounts/EUESA/bulletins/1e5452e https://www.nasa.gov/sites/default/files/atoms/files/webb_irb_report_and_response_0.pdf http://m.esa.int/spaceinvideos/Videos/2018/07/JWST_a_beacon_for_science https://www.surveymonkey.com/r/JWSTSurvey https://www.space.com/nasa-james-webb-space-telescope-worth-wait.html https://www.jpl.nasa.gov/news/news.php?feature=7579 http://www.esa.int/ESA_Multimedia/Images/2020/04/James_Webb_Space_Telescope_s_primary_mirror_unfolded https://content.govdelivery.com/accounts/EUESA/bulletins/2961158 https://www.nasa.gov/press-release/nasa-announces-new-james-webb-space-telescope-target-launch-date/ https://www.nytimes.com/2020/07/16/science/nasa-james-webb-space-telescope-delay.html https://www.nasa.gov/feature/goddard/2021/nasa-s-james-webb-space-telescope-completes-final-functional-tests-to-prepare-for-launch https://www.space.com/james-webb-space-telescope-final-mirror-test https://esamultimedia.esa.int/docs/science/Webb-LaunchKit_EN.pdf https://www.esa.int/Science_Exploration/Space_Science/Webb/Webb_passes_key_launch_clearance_review https://www.space.com/james-webb-space-telescope-passes-launch-review https://www.esa.int/Science_Exploration/Space_Science/Webb/Webb_completes_testing_and_prepares_for_trip_to_Europe_s_Spaceport https://www.nasa.gov/press-release/nasa-readies-james-webb-space-telescope-for-december-launch https://www.esa.int/Science_Exploration/Space_Science/Webb/Targeted_launch_date_for_Webb_18_December_2021 https://www.space.com/james-webb-space-telescope-how-and-why https://en.wikipedia.org/wiki/James_Webb_Space_Telescope
2022, Jan 9-13	American Astronomical Society 239th Meeting, 9-13 January 2022, Salt Lake City (UT, USA). See: https://aas.org/meetings/future-aas-meetings
2022, Jan 7	Apollo NEA 2020 AP1 ($H = 29.6$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 4.54 LD. Minimum miss distance 0.0027 LD (= 0.16 R_{Earth} from the geocenter). See: 2020 AP1 – S2P , 2020 AP1 - JPL See also: 2 Jan 2020.
2022, Jan 18	Apollo NEA 7482 (1994 PC1, $H = 16.7$ mag, $D \approx 1300$ m, PHA)

	will pass Earth at 5.15 LD. Minimum miss distance 5.15 LD. See: 7482 1994 PC1 - SSA , 1994 PC1 - JPL See also: https://en.wikipedia.org/wiki/(7482)_1994_PC1 See also: 17 Jan 1933.
2022, Jan 24-25	26th Meeting of the NASA Small Bodies Assessment Group, 24-25 January 2022, virtual meeting. See: http://www.lpi.usra.edu/sbag/meetings/ https://www.lpi.usra.edu/sbag/meetings/jun2021/SBAG_2021_June_Agenda.pdf
2022, Mar 4	Apollo NEA 138971 (2001 CB21), $H = 18.6$ mag, $D \approx 578$ m, PHA) will pass Earth at 12.78 LD. Minimum miss distance 12.78 LD. Flyby target for AIDA mission. See: 138971 2001 CB21- SSA , 2001 CB21 - JPL
2022, Mar 28	Atira NEA 2019 LF6 ($H = 17.2$ mag, $D \approx 1300$ m) will pass Earth at 103 LD. Minimum miss distance 102 LD. See: 2019 LF6 - SSA , 2019 LF6 - JPL See also: https://www.caltech.edu/about/news/ztf-spots-asteroid-shortest-year
2022, May 30	Aten NEA 2021 KO2 ($H = 28.1$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 2.78 LD. Minimum miss distance 0.99 LD. See: 2021 KO2 – S2P , 2021 KO2 - JPL See also: 30 May 2021.
2022, Jun 12-16	American Astronomical Society 240th Meeting, 12-16 June 2022, Pasadena (CA, USA). See: https://aas.org/meetings/future-aas-meetings
2022, Jun 13-17	Meteoroids 2022 Conference, June 13–17 2022, Huntsville (AL), USA. See: https://www.hou.usra.edu/meetings/meteoroids2022/
2022, Jun 30	Asteroid Day 2022. See: http://www.asteroidday.org/
2022, Jul 16-24	44th COSPAR Scientific Assembly, 16-24 July, Athens (Greece). See: https://www.cospar-assembly.org https://www.cosparathens2022.org
2022, Aug	85th Annual Meeting of the Meteoritical Society, Aug 2022, Glasgow (UK). See: https://meteoritical.org/society/annual-meetings

2022, Aug	IAU XXXI General Assembly, Busan (Republic of Korea), 16–27 August 2021. Postponed to August 2022. See: https://www.iau.org/science/meetings/future/general_assemblies/1181/ The IAU GA Business Meetings, including the elections for the next three years provided for in the IAU Bye-Laws, will take place in August 2021, as virtual meetings. Including: IAU Symposium No. 374, Astronomical hazards for life on Earth, Busan, 16–19 August 2021. Postponed to August 2022. See: https://www.iau.org/science/meetings/future/symposia/2591/
2022, Sep 18-23	Europlanet Science Congress (EPSC) 2022, Granada (Spain), 18 – 23 September 2022. See: https://www.europlanet-society.org/european-planetary-science-congress/
2022, Oct 2-7	54th Annual Meeting of the AAS Division for Planetary Sciences, 2–7 October 2022, London (Canada). See: https://dps.aas.org/meetings/future
2022, Oct 4	Apollo NEA 65803 Didymos (1996 GT, $H = 18.1$ mag, $D \approx 780 + 160$ m, PHA) will pass Earth at 27.72 LD (= 0.07 AU). Minimum miss distance 27.72 LD. Flyby target for AIDA mission. See: 65803 Didymos - SSA , 1996 GT - JPL See also: https://en.wikipedia.org/wiki/65803_Didymos See also: 12 Nov 2003, 29 May 2012, 20 Oct 2062, 4 Nov 2123.
2022, Nov 16	Apollo NEA 2018 WH ($H = 30.0$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 2.49 LD. Minimum miss distance 0.38 LD. See: 2018 WH - SSA , 2018 WH - JPL See also: 16 Nov 2018.
2022, Nov 23	Apollo NEA 2005 LW3 ($H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 2.97 LD. Minimum miss distance 2.96 LD. See: 2005 LW3 - JPL , 2005 LW3 - SSA See also: 20 Nov 1928, 22 Nov 2084.
2022, Dec 27	Aten NEA 2010 XC15 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 2.01 LD. Minimum miss distance 2.01 LD. See: 2010 XC15 - SSA , 2010 XC15 - JPL See also: http://en.wikipedia.org/wiki/2010_XC15 See also: 26 Dec 1907, 27 Dec 1914, 27 Dec 1976, 28 Dec 2059, 26 Dec 2064, 26 Dec 2096.

2023, Jan 8-12	<i>American Astronomical Society 241th Meeting</i> , 8-12 January 2023, Seattle (WA, USA). See: https://aas.org/meetings/future-aas-meetings
2023, Jan 20	Apollo NEA 2020 BP ($H = 25.7$ mag, $D \approx 26$ m) will pass Earth at a nominal miss distance of 5.19 LD. Minimum miss distance 0.43 LD. See: 2020 BP – S2P , 2020 BP – JPL
2023, Feb 3	Apollo NEA 367789 (2011 AG5) , $H = 22.0$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 4.73 LD. Minimum miss distance 4.72 LD. See: 367789 2011 AG5 - SSA , 2011 AG5 - JPL See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2012-051 http://www.jpl.nasa.gov/news/news.cfm?release=2012-051 http://www.space.com/14683-big-asteroid-2011-ag5-threat-earth.html http://www.space.com/14782-asteroid-threat-earth-impact-2011ag5.html http://blogs.discovermagazine.com/badastronomy/files/2012/03/schweikart_letter_NASA_AG5.pdf http://www.space.com/14872-asteroid-2011-ag5-earth-impact.html http://en.wikipedia.org/wiki/2011_AG5 See also: 26 Feb 2011 , 4 Feb 2040 .
2023, Jun 4-8	<i>American Astronomical Society 242th Meeting</i> , 4-8 June 2023, Albuquerque (NM, USA). See: https://aas.org/meetings/future-aas-meetings
2023, Jun 30	<i>Asteroid Day 2023</i> . See: http://www.asteroidday.org/
2023, Jul 3-8	<i>86th Annual Meeting of the Meteoritical Society</i> , 3-8 July 2023, Perth (Australia). See: https://meteoritical.org/society/annual-meetings
2023, Sep 24	Expected return of NASA spacecraft <i>Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer (OSIRIS-REx)</i> , an asteroid sample return mission, from target asteroid 101955 (1999 RQ36 = Bennu) , $H = 20.8$ mag, $D \approx 575$ m, NEO, PHA). The 2,110-kg spacecraft, launched aboard an Atlas V 411 rocket on 8 September 2016; rendezvous 3 December 2018. After a careful survey of Bennu to characterize the asteroid and locate the most promising sample sites, OSIRIS-REx will collect between 60 to 2,000 grams of surface material with its robotic arm and return the sample to Earth via a detachable capsule on 24 September 2023. The capsule containing the sample will be collected at the Utah Test and Training Range. For two years after the sample return (from late 2023-2025) the science team will catalog

	the sample and conduct the analysis needed to meet the mission science goals. NASA will preserve at least 75% of the sample at NASA's Johnson Space Flight Center in Houston for further research by scientists worldwide, including future generations of scientists. See: http://www.nasa.gov/osiris-rex http://science.nasa.gov/missions/osiris-rex/ http://www.asteroidmission.org/objectives/ http://www.nasa.gov/topics/solarsystem/features/osiris-rex.html http://www.nasa.gov/mission_pages/osiris-rex/index.html http://pirlwww.lpl.arizona.edu/~guym/OSIRIS-REx.pdf http://www.space.com/11802-nasa-asteroid-mission-dangerous-1999-rq36.html http://www.space.com/11808-nasa-asteroid-mission-osiris-rex-1999-rq36-infographic.html http://www.space.com/12065-osiris-rex-asteroid-generations.html http://web.mit.edu/newsoffice/2011/asteroid-mission-0726.html http://www.theithacajournal.com/article/20110828/NEWS01/108280327/Campus-Watch-Ithaca-College-professor-receives-NASA-grant-asteroid-study?odyssey=nav%7Chead http://www.space.com/13132-potentially-killer-asteroids-earth-nasa.html http://www.nasa.gov/press/2014/april/construction-to-begin-on-nasa-spacecraft-set-to-visit-asteroid-in-2018/ http://adsabs.harvard.edu/abs/2016Sci...353..974V http://iopscience.iop.org/article/10.1088/2058-7058/29/10/11/meta https://ww2.kqed.org/science/2017/09/29/why-is-nasa-checking-out-this-asteroid/ https://www.cosmos.esa.int/documents/336356/336472/SMPAG_OREx_Update_Johnson_2020-02-06+%281%29.pdf/ https://www.nasa.gov/press-release/nasa-invites-public-media-to-watch-asteroid-mission-begin-return-to-earth https://en.wikipedia.org/wiki/OSIRIS-REx See also: 29 Dec 2009.
2023, Oct 1-6	<i>Europlanet Science Congress (EPSC) 2023</i>, San Antonio (TX, USA), 1 – 6 October 2023, jointly with 55th DPS. See: https://www.europlanet-society.org/european-planetary-science-congress/
2023, Oct 1-6	<i>55th Annual Meeting of the AAS Division for Planetary Sciences (DPS)</i>, 1-6 October 2023, San Antonio (TX, USA). See: https://dps.aas.org/meetings/future
2023, Oct 17	Apollo NEA 1998 HH49 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 3.05 LD. Minimum miss distance 3.01 LD. See: 1998 HH49 - JPL , 1998 HH49 - SSA
2023, Nov 25	Apollo NEA 2019 UT6 ($H = 22.2$ mag, $D \approx 130$ m) will pass Earth at

	a nominal miss distance of 6.37 LD. Minimum miss distance 6.02 LD. See: 2019 UT6 – SSA , 2019 UT6 – JPL
2023, Dec 23	Apollo NEA 2020 YO3 ($H = 24.7$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 3.55 LD. Minimum miss distance 0.52 LD. See: 2020 YO3 – S2P , 2020 YO3 – JPL
2024	Launch of the ESA spacecraft Hera, which will be, along with NASA's DART spacecraft, the first mission to rendezvous with the binary asteroid Didymos ($D \approx 780$ m + 160 m). In October 2022 DART will perform a kinetic impact on the smaller binary component, Dimorphos. In 2026 Hera will follow-up with a post-impact survey of the binary asteroid, to investigate the effect of this planetary defence technique. DART and Hera were conceived together as part of the international Asteroid Impact Deflection Assessment (AIDA) collaboration. The two missions are valuable individually, but by being flown in concert their overall scientific and technological return is more than doubled. Hera, a further optimisation of ESA's earlier Asteroid Impact Mission (AIM), was agreed for launch at the Agency's Space19+ Council of Ministers at European Level in November 2019. See: https://www.esa.int/Safety_Security/Hera See also: https://www.nasa.gov/planetarydefense/dart https://www.iau.org/news/pressreleases/detail/iau2007/?lang https://en.wikipedia.org/wiki/65803_Didymos https://en.wikipedia.org/wiki/Dimorphos https://en.wikipedia.org/wiki/AIDA_(mission)#Hera https://en.wikipedia.org/wiki/Double_Asteroid_Redirection_Test https://www.space.com/nasa-delays-dart-asteroid-mission-launch-2022
2024, Jan 7-11	American Astronomical Society 243th Meeting, 7-11 January 2024, New Orleans (LA, USA). See: https://aas.org/meetings/future-aas-meetings
2024, Jan 16	Aten NEA 2021 CZ2 ($H = 22.5$ mag, $D \approx 110$ m) will pass Earth at a nominal miss distance of 7.99 LD. Minimum miss distance 0.95 LD. See: 2021 CZ2 – S2P , 2021 CZ2 - JPL
2024, Mar 18	Apollo NEA 2020 FD ($H = 27.7$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 5.80 LD. Minimum miss distance 0.04 LD. See: 2020 FD – S2P , 2020 FD - JPL See also: 18 March 2020
2024, Apr 19	Apollo NEA 2017 SA20 ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a

	nominal miss distance of 3.81 LD. Minimum miss distance 0.03 LD. See: 2017 SA20 - JPL , 2017 SA20 - SSA See also: 26 Apr 1997 .
2024, Jun 30	<i>Asteroid Day 2024.</i> See: http://www.asteroidday.org/
2024, mid	Foreseen launch of JAXA spacecraft <i>DESTINY+ (Demonstration and Experiment of Space Technology for INterplanetary voYage Phaethon fLyby dUSt science)</i> , a planned mission to flyby the meteor shower parent body 3200 Phaethon , as well as various minor bodies originating from the "rock comet". See: http://fanfun.jaxa.jp/jaxatv/files/20170920_dlr_e.pdf See also: https://en.wikipedia.org/wiki/DESTINY%2B
2024, Jul/Aug	<i>87th Annual Meeting of the Meteoritical Society</i> , July/August 2024, Brussels (Belgium, EU). See: https://meteoritical.org/society/annual-meetings
2024, Sept 15-20	<i>Europlanet Science Congress (EPSC) 2023</i> , Helsinki (Finland), 15-20 Sept 2024. See: https://www.europlanet-society.org/european-planetary-science-congress/
2024, Oct 6-11	<i>56th Annual Meeting of the AAS Division for Planetary Sciences</i> , 6-11 October 2024, Boise (ID, USA). See: https://dps.aas.org/meetings/future
2024, Oct 13	Amor NEA 1036 Ganymed (A924 UB) , $H = 9.6$ mag, $D = 36.5$ km), largest NEA known, will pass Earth at a nominal miss distance of 146 LD. Minimum miss distance 146 LD. See: 1036 Ganymed - SSA , 1924 TD - JPL Ref: J. Meeus, M. Drummen, September 2011, <i>Zenit</i> , " Ganymed in aantocht." See: http://www.dekoepel.nl/zenit/september2011.html See also: http://en.wikipedia.org/wiki/1036_Ganymed See also: 13 Oct 2011 .
2024, Nov 1	Aten NEA 2016 VA ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 1.47 LD. Minimum miss distance 0.30 LD. See: 2016 VA - SSA , 2016 VA - JPL See also: 2 Nov 1938 , 2 Nov 2016 .
2024, Dec 11	Apollo NEA 2007 XB23 ($H = 27.1$ mag, $D \approx 14$ m) will pass Earth at

	a nominal miss distance of 1.16 LD. Minimum miss distance 0.25 LD. See: 2007 XB23 - SSA , 2007 XB23 - JPL See also: 13 Dec 2007.
2024, late	Foreseen launch of the <i>Near Earth Object Surveillance Mission (NEOSM)</i>. The new <i>NEO Surveillance Mission</i> will be similar to the <i>NEOCam</i> mission previously proposed to NASA's Discovery program, but instead run as a directed mission as part of the agency's planetary defense efforts. The spacecraft will have a total mass of no more than 1,300 kg, allowing it to launch on a vehicle like an Atlas 5 or Falcon 9 to the Sun–Earth Lagrange point L1. Foreseen launch date: late 2024. In 2005, the US Congress mandated NASA to achieve by the year 2020 a completeness level of 90% for discovering, cataloging, and characterizing dangerous asteroids larger than 140 meters. However, the 140-m NEO threat discovery estimate was just under 36% at the end of 2019. <i>NEOSM</i> should reach the 90% congressional goal within 10 years, with an anticipated mission lifetime of 12 years. Re: - J. Foust, <i>SpaceNews</i>, 23 September 2019, “NASA to develop mission to search for near-Earth asteroids.” See: https://spacenews.com/nasa-to-develop-mission-to-search-for-near-earth-asteroids/ See also: https://neocam.ipac.caltech.edu/ https://www.sciencemag.org/news/2019/09/nasa-build-telescope-detecting-asteroids-threaten-earth https://www.universetoday.com/143527/this-summer-asteroid-near-miss-helped-greenlight-nasas-neocam-mission-to-search-the-skies-for-killer-spacerocks/ https://www.cosmos.esa.int/documents/336356/336472/PDCO_Brief_to_SMPAG_-_Johnson_2020-02-06+%281%29.pdf https://en.wikipedia.org/wiki/Near-Earth_Object_Surveillance_Mission
2025, Jan 12-16	<i>American Astronomical Society 245th Meeting</i>, 12-16 January 2025, National Harbour (MD, USA). See: https://aas.org/meetings/future-aas-meetings
2025, Jun	<i>American Astronomical Society 246th Meeting</i>, June 2025, Anchorage (AK, USA). See: https://aas.org/meetings/future-aas-meetings
2025, Jun 30	<i>Asteroid Day 2025</i>. See: http://www.asteroidday.org/

2026, first half	Foreseen launch of Near-Earth Object Surveyor space telescope (NEO Surveyor). See: https://www.nasa.gov/feature/nasa-approves-asteroid-hunting-space-telescope-to-continue-development See also: https://www.jpl.nasa.gov/news/asteroid-hunting-space-telescope-gets-two-year-mission-extension
2026, Jan 4-8	American Astronomical Society 247th Meeting, 4-8 January 2026, Phoenix (AZ, USA). See: https://aas.org/meetings/future-aas-meetings
2026, Feb 12	Aten NEA 1999 AO10 ($H = 24.0$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 10.43 LD. Minimum miss distance 10.36 LD. Possible target for NASA manned mission, with launch date 19 September 2025 and a 155 day mission duration. See: 1999 AO10 - SSA , 1999 AO10 - JPL See also: http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/awst/2010/08/16/AW_08_16_2010_p30-247032.xml&headline=NASA%20Narrows%20Potential%20Asteroid%20List http://www.nasaspaceflight.com/2010/01/nasas-flexible-path-2025-human-mission-visit-asteroid/ http://www.nasa.gov/pdf/474223main_Johnson_ExploreNOW.pdf http://www.spacegeneration.org/index.php/eventsttopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf http://en.wikipedia.org/wiki/1999_AO10
2026, Apr 14	Aten NEA 2013 GM3 ($H = 26.3$ mag, $D \approx 20$ m) will pass Earth at a nominal miss distance of 0.68 LD. Minimum miss distance 0.02 LD. [2026-01] See: 2013 GM3 - SSA , 2013 GM3 - JPL
2026, Jun 30	Asteroid Day 2026. See: http://www.asteroidday.org/
2026, Oct 25-30	58th Annual Meeting of the AAS Division for Planetary Sciences, 25-30 October 2026, Spokane (WA, USA). See: https://dps.aas.org/meetings/future
2027, Jan 28	Apollo NEA 2020 OP3 ($H = 20.8$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 7.67 LD. Minimum miss distance 5.13 LD. See: 2020 OP3 – S2P , 2020 OP3 - JPL

	See also: 29 Jan 1986, 29 Jan 2046.
2027, May or earlier	Foreseen launch of the Nancy Grace Roman Space Telescope, formerly known as the Wide-Field InfraRed Survey Telescope. The Roman Space Telescope will be NASA's next large space astrophysics observatory after JWST. Both missions are built on the legacy of Hubble. Whereas JWST offers superior sensitivity over Hubble, Roman will provide a panoramic field of view that is 100 times greater than Hubble's, leading to the first wide-field maps of the universe at space-based resolution Roman can search for new dwarf planets, comets, and asteroids in our solar system. See: https://roman.gsfc.nasa.gov/ https://www.stsci.edu/roman http://www.stsci.edu/wfirst/about/wfirst-advisory-committee-wstac See also: https://www.stsci.edu/contents/newsletters/2020-volume-37-issue-01/community-science-with-the-nancy-grace-roman-space-telescope https://roman.gsfc.nasa.gov/science/Early-definition_Astrophysics_Survey_Option.html https://roman.gsfc.nasa.gov/science/workshop112021/ https://en.wikipedia.org/wiki/Nancy_Grace_Roman_Space_Telescope
2027, Jun 6	Apollo NEA 4953 (1990 MU), $H = 15.2$ mag, $D \approx 2800$ m, PHA) will pass Earth at a nominal miss distance of 12.0 LD. Minimum miss distance 12.0 LD. See: 4953 1990 MU - SSA , 1990 MU - JPL See also: https://www.space.com/six-asteroids-will-buzz-earth-late-2020s.html http://en.wikipedia.org/wiki/(4953)_1990_MU See also: 5 Jun 2058.
2027, Jun 30	Asteroid Day 2027. See: http://www.asteroidday.org/
2027, Aug 7	Apollo NEA 137108 (1999 AN10), $H = 18.4$ mag, $D \approx 700$ m, PHA) will pass Earth at a nominal miss distance of 1.014 LD. Minimum miss distance 1.010 LD. See: 137108 1999 AN10 - SSA , 1999 AN10 - JPL Ref: - P.W. Chodas, 18 May 1999, "The continuing story of asteroid 1999 AN10." See: http://neo.jpl.nasa.gov/news/news017.html - A. Milani, S.R. Chesley, G.B. Valsecchi, 1999, <i>Astronomy & Astrophysics</i> (Letters), 346, L65, "Close approaches of asteroid 1999 AN10: resonant and non-resonant returns." See: http://adsabs.harvard.edu/abs/1999A%26A...346L..65M - D. Morrison, C.R. Chapman, D. Steel, R.P. Binzel, 2004, in: M.J.S.

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2027, Oct 4, 00:14	Apollo NEA 2018 FK5 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 4.46 LD. Minimum miss distance 0.18 LD. See: 2018 FK5 - SSA , 2018 FK5 - JPL See also: 30 Mar 2018.
2027, Oct 4, 01:28	Apollo NEA 2020 SN6 ($H = 28.8$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 3.68 LD. Minimum miss distance 0.17 LD. See: 2020 SN6 – 2SP , 2020 SN6 – JPL See also: 16 Feb 2015.
2027, Dec 2	Aten NEA 2020 XF ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 1.84 LD. Minimum miss distance 0.97 LD. See: 2020 XF – S2P , 2020 XF – JPL See also: 3 Dec 2020.
2028 , Jan 19	Aten NEA 2020 AW ($H = 28.7$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 4.22 LD. Minimum miss distance 0.98 LD. See: 2020 AW – S2P , 2020 AW – JPL
2028, May 7	Aten NEA 2000 SG344 ($H = 25.1$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 7.63 LD. Minimum miss distance 7.51 LD. See: 2000 SG344 - SSA , 2000 SG344 - JPL See also: http://en.wikipedia.org/wiki/2000_SG344 See also: 6 May 1999, 13 Sep 2072.
2028, May 19	Apollo NEA 2021 EO2 ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 0.97 LD. Minimum miss distance 0.40 LD. [2028-01] See: 2021 EO1 – S2P , 2021 EO1 – JPL
2028, May 20	Apollo NEA 2009 WR52 ($H = 28.6$ mag, $D \approx 7$ m) will pass Earth at

	a nominal miss distance of 1.97 LD. Minimum miss distance 0.52 LD. See: 2009 WR52 - SSA , 2009 WR52 - JPL
2028, Jun 26	Apollo NEA 153814 (2001 WN5, $H = 18.5$ mag, $D \approx 932$ m, PHA) will pass Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.65 LD. [2028-02] See: 153814 2001 WN5 - SSA , 2001 WN5 - JPL See also: https://www.space.com/six-asteroids-will-buzz-earth-late-2020s.html http://en.wikipedia.org/wiki/(153814)_2001_WN5
2028, Jun 30	<i>Asteroid Day 2028.</i> See: http://www.asteroidday.org/
2028, Jul 25	Apollo NEA 2011 LJ19 ($H = 21.2$ mag, $D \approx 210$ m, PHA) will pass Earth at a nominal miss distance of 3.31 LD. Minimum miss distance 0.72 LD. See: 2011 LJ19 - SSA , 2011 LJ19 - JPL
2028, Sep 7	Aten NEA 2021 RS100 ($H = 28.8$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 9.89 LD. Minimum miss distance 0.07 LD. See: 2021 RS100 – S2P , 2021 RS100 - JPL See also: 7 Sep 2021.
2028, Oct 26	Apollo NEA 35396 (1997 XF11, $H = 17.3$ mag, $D = 1200$ m, PHA) will pass Earth at a nominal miss distance of 2.417 LD. Minimum miss distance 2.416 LD. See: 35396 1997 XF11 - SSA , 1997 XF11 - JPL See also: 11 Mar 1998, 27 Oct 2095. See also: https://www.space.com/six-asteroids-will-buzz-earth-late-2020s.html http://en.wikipedia.org/wiki/(35396)_1997_XF11
2028, Dec 30	Aten NEA 2012 XE133 ($H = 23.5$ mag, $D \approx 70$ m) will pass Earth at a nominal miss distance of 3.84 LD. Minimum miss distance 3.84 LD. See: 2012 XE133 - SSA , 2012 XE133 - JPL Ref: - C. de la Fuente Marcos, R. de la Fuente Marcos, 21 June 2013, <i>Monthly Notices of the Royal Astronomical Society</i>, 432, 886, "Asteroid 2012 XE133, a transient companion to Venus." See: http://adsabs.harvard.edu/abs/2013MNRAS.432..886D See also: https://en.wikipedia.org/wiki/2012_XE133

2029, Jan 28 04:24	Apollo NEA 292220 (2006 SU49), $H = 19.7$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 3.19 LD. Minimum miss distance 3.19 LD. See: 2006 SU49 - JPL , 2006 SU49 - SSA See also: https://www.space.com/six-asteroids-will-buzz-earth-late-2020s.html https://en.wikipedia.org/wiki/(292220)_2006_SU49 See also: 29 Jan 1977, 30 Jan 1982.
2029, Apr 13, 21:46	Aten NEA 99942 Apophis (2004 MN4), $H = 19.7$ mag, $D \approx 370$ m, orbital $P = 0.89$ yr, PHA) will pass Earth at a nominal miss distance of 0.098 LD (= 5.92 $R_{\text{Earth}} = 37,727$ km from the geocenter) with a relative velocity of 7.42 km/s. Minimum miss distance 0.096 LD (= 5.81 $R_{\text{Earth}} = 37,030$ km from the geocenter). [2029-01] As a result of its close passage, this minor planet will move from the Aten to the Apollo class. Probability of impact on 12 April 2068: $\sim 1:150,000$. See: 99942 Apophis - SSA , 2004 MN4 - JPL See also: http://neo.jpl.nasa.gov/risk/a99942.html http://neo.jpl.nasa.gov/apophis/ https://cneos.jpl.nasa.gov/doc/apophis/ http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2013-017 http://neo.jpl.nasa.gov/news/news178.html https://www.space.com/six-asteroids-will-buzz-earth-late-2020s.html https://iaaweb.org/iaa/Scientific%20Activity/pdcstatement3.pdf https://www.space.com/asteroid-apophis-2029-flyby-planetary-defense.html http://en.wikipedia.org/wiki/99942_Apophis Ref: - A.M. MacRobert, 15 February 2005, <i>Sky & Telescope</i>, 109 (5), 16, "Asteroid 2004 MN4: a really near miss!" See: http://adsabs.harvard.edu/abs/2005S%26T...109e..16M - D. Chandler, 2005, <i>New Scientist</i>, 25 June 2005, issue 2505, "Killer asteroid: too close for comfort." See: http://www.newscientist.com/article/mg18625051.200-killer-asteroid-too-close-for-comfort.html - B.G. Marsden, 2007, in: P. Bobrowsky & H. Rickman (eds.), 2007, <i>Comet/Asteroid Impacts and Human Society</i> (Berlin: Springer), p. 505, "Impact risk communication management (1998 – 2004): Has it improved?" See: http://adsabs.harvard.edu/abs/2007caih.book.....B - J.D. Giorgini, L.A.M. Benner, S.J. Ostro, et al., 2008, <i>Icarus</i>, 193, 1, "Predicting the Earth encounters of (99942) Apophis." See: http://adsabs.harvard.edu/abs/2008Icar..193....1G

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2029, May 13, 22:5	Apollo NEA 2000 SL10 ($H = 22.5$ mag, $D \approx 110$ m, PHA) will pass Earth at a nominal miss distance of 4.64 LD. Minimum miss distance 4.26 LD. See: 2000 SL10 - JPL , 2000 SL10 - SSA See also: 15 May 1915.
2029, Jun 30	<i>Asteroid Day 2029</i>. See: http://www.asteroidday.org/

2029, Oct 20	Apollo NEA 2008 UA202 ($H = 29.3$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 5.74 LD. Minimum miss distance 0.04 LD. See: 2008 UA202 - SSA , 2008 UA202 - JPL See also: 18 Oct 2008.
2029, Oct 25	Aten NEA 2021 UO1 ($H = 28.0$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 2.79 LD. Minimum miss distance 0.14 LD. See: 2021 UO1 – S2P , 2021 UO1 - JPL See also: 24 Oct 1922, 25 Oct 2021.
2029, Nov 11	Apollo NEA 2001 AV43 ($H = 24.7$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 0.81 LD. Minimum miss distance 0.81 LD. [2029-02] See: 2001 AV43 - SSA , 2001 AV43 - JPL See also: https://en.wikipedia.org/wiki/2001_AV43
2029, Dec 24	Apollo NEA 2020 YB1 ($H = 26.8$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 2.04 LD. Minimum miss distance 0.76 LD. See: 2020 YB1 – S2P , 2020YB1 – JPL
2030, Apr 2	Apollo NEA 2021 GE2 ($H = 29.0$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 5.89 LD. Minimum miss distance 0.0045 LD (= 0.273 R_{Earth} from the geocenter). See: 2021 GE2 – S2P , 2021 GE2 - JPL See also: 2 Apr 1942, 3 Apr 2021.
2030, Jun 30	Asteroid Day 2030. See: http://www.asteroidday.org/
2030, Oct 30	Apollo NEA 2017 UJ2 ($H = 31.0$ mag, $D \approx 2.2$ m) will pass Earth at a nominal miss distance of 31.66 LD. Minimum miss distance 0.75 LD. See: 2017 UJ2 - SSA , 2017 UJ2 - JPL See also: 20 Oct 1978, 20 Oct 2017.
2031, Jan 20	Apollo NEA 2018 BD ($H = 30.2$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 6.15 LD. Minimum miss distance 0.08 LD. See: 2018 BD - SSA , 2018 BD - JPL See also: https://www.cnet.com/news/asteroid-2018-bd-earth-potentially-hazardous-2002-aj129/ See also: 18 Jan 2018.

2031, Feb 19	Apollo NEA 2021 DG ($H = 30.1$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 2.87 LD. Minimum miss distance 0.18 LD. See: 2021 DG – S2P , 2021 DG – JPL See also: 18 Feb 1980 , 18 Feb 2021 .
2031, Mar 19	Apollo NEA 2019 UH9 ($H = 24.2$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 8.31 LD. Minimum miss distance 0.40 LD. See: 2019 UH9 – SSA , 2019 UH9 – JPL
2031, May 1	Atira NEA 2021 PH27 ($H = 17.73$ mag, $D \approx 1000$ m) will pass Earth at a nominal miss distance of 0.26 AU (= 99 LD). Minimum miss distance 0.16 AU (= 64 LD). See: 2021 PH27 – S2P , 2021 PH27 – JPL See also: https://www.minorplanetcenter.net/mpec/K21/K21Q41.html https://noirlab.edu/public/news/noirlab2123/ https://www.space.com/solar-system-fastest-orbiting-asteroid-2021-ph27 See also: 25 April 2021 .
2031, May 24	Apollo NEA 2020 KQ4 ($H = 26.5$ mag, $D \approx 18$ m) will pass Earth at a nominal miss distance of 3.72 LD. Minimum miss distance 0.92 LD. See: 2020 KQ4 – S2P , 2020 KQ4 – JPL See also: 23 May 1971 .
2031, Sep 26	Apollo NEA 2016 SW1 ($H = 28.8$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 6.33 LD. Minimum miss distance 0.50 LD. See: 2016 SW1 – SSA , 2016 SW1 – JPL
2032 , Feb 11	Aten NEA 2021 DR ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 1.97 LD. Minimum miss distance 0.39 LD. See: 2021 DR – S2P , 2021 DR - JPL
2032, Feb 25	Apollo NEA 2018 DU ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 1.99 LD. Minimum miss distance 0.66 LD. See: 2018 DU - SSA , 2018 DU - JPL See also: 25 Feb 2018 .
2032, Feb 29	Apollo NEA 2019 EH1 ($H = 29.9$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 0.89 LD. Minimum Earth miss distance 0.046 LD (= 2.78 R_{Earth} from geocenter). [2032-01] See: 2019 EH1 - SSA , 2019 EH1 - JPL See also: 1 Mar 2019 .
2032, Aug 14	Apollo NEA 2008 DB ($H = 26.0$ mag, $D \approx 22$ m) will pass Earth at a

	nominal miss distance of 0.33 LD. Minimum miss distance 0.33 LD. [2032-02] See: 2008 DB - SSA , 2008 DB - JPL
2033 , Mar 17	Apollo NEA 2019 FA ($H = 28.7$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 3.22 LD. Minimum miss distance 0.03 LD. See: 2019 FA - SSA , 2019 FA - JPL See also: 16 Mar 2019 .
2033, Apr 5	Apollo NEA 2020 GY1 ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 2.42 LD. Minimum miss distance 0.22 LD. See: 2020 GY1 – S2P , 2020 GY1 - JPL See also: 2 Apr 1913 , 5 Apr 2020 .
2034 , Jan 5	Apollo NEA 2019 AH3 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 3.05 LD. Minimum miss distance 0.23 LD. See: 2019 AH3 - SSA , 2019 AH3 - JPL
2034, Jan 29	Apollo NEA 2019 BG3 ($H = 26.2$ mag, $D \approx 21$ m) will pass Earth at a nominal miss distance of 6.86 LD. Minimum miss distance 0.54 LD. See: 2019 BG3 - SSA , 2019 BG3 - JPL
2034, Feb 8	Apollo NEA 2018 CC ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 7.32 LD. Minimum miss distance 0.14 LD. See: 2018 CC - SSA , 2018 CC - JPL See also: https://www.jpl.nasa.gov/news/news.php?feature=7055 http://earthsky.org/space/asteroids-feb-2018-cb-and-2018-cc-online-viewing See also: 6 Feb 2018 .
2034, May 6	Apollo NEA 2014 HB177 ($H = 28.4$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 1.34 LD. Minimum miss distance 0.21 LD. See: 2014 HB177 - SSA , 2014 HB177 - JPL See also: 6 May 1974 , 6 May 2014 .
2034, May 11	Aten NEA 2021 JZ5 ($H = 28.4$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 4.92 LD. Minimum miss distance 0.45 LD. See: 2021 JZ5 – S2P , 2021 JZ5 - JPL See also: 11 May 1971 .
2034, Jul 26	Aten NEA 2021 OC1 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 8.04 LD. Minimum miss distance 0.19 LD. See: 2021 OD1 – S2P , 2021 OD1 - JPL

	See also: 29 Jul 1983 , 27 Jul 2062 .
2034, Oct 4	Apollo NEA 2017 TA ($H = 24.8$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 1.88 LD. Minimum miss distance 0.61 LD. See: 2017 TA – S2P , 2017 TA – JPL
2034, Oct 5	Apollo NEA 2017 TB ($H = 29.3$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 4.34 LD. Minimum miss distance 0.24 LD. See: 2017 TB - SSA , 2017 TB - JPL
2034, Oct 15	Apollo NEA 2020 UE ($H = 25.6$ mag, $D \approx 27$ m) will pass Earth at a nominal miss distance of 4.15 LD. Minimum miss distance 0.17 LD. See: 2020 UE – S2P , 2020 UE - JPL See also: 15 Oct 2020 .
2035 , Feb 17	Apollo NEA 2016 DY21 ($H = 25.7$ mag, $D \approx 25$ m) will pass Earth at a nominal miss distance of 4.15 LD. Minimum miss distance 0.20 LD. See: 2016DY21 - SSA , 2016 DY21 - JPL
2035, Mar 30	Aten NEA 2002 GQ ($H = 26.8$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 7.50 LD. Minimum miss distance 0.73 LD. See: 2002 GQ - SSA , 2002 GQ - JPL See also: 30 Mar 1962 .
2035, Apr 4	Apollo NEA 2008 GM2 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 1.91 LD. Minimum miss distance 0.97 LD. See: 2008 GM2 - SSA , 2008 GM2 - JPL
2035, Apr 7	Apollo NEA 2020 GB1 ($H = 27.0$ mag, $D \approx 14$ m) will pass Earth at a nominal miss distance of 1.34 LD. Minimum miss distance 0.13 LD. See: 2020 GB1 – S2P , 2020 GB1 – JPL See also: 10 Oct 2000 .
2035, Oct 6	Apollo NEA 536531 (2015 DV215) , $H = 20.4$ mag, $D \approx 290$ m, PHA) will pass Earth at a nominal miss distance of 2.91 LD. Minimum miss distance 2.91 LD. See: 2015 DV215 - JPL , 2015 DV215 - SSA See also: 8 Oct 2134 .
2035, Oct 20	Apollo NEA 2020 HJ4 ($H = 20.2$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 8.18 LD. Minimum miss distance 8.00 LD. See: 2020 HJ4 – S2P , 2020 HJ4 – JPL See also: 21 Oct 1934 .

2035, Dec 2	Aten NEA 2020 XG ($H = 28.1$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 2.21 LD. Minimum miss distance 0.60 LD. See: 2020 XG – S2P , 2020 XG – JPL
2036, Feb 13	Apollo NEA 2021 CN5 ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 7.07 LD. Minimum miss distance 0.62 LD. See: 2021 CN5 – S2P , 2021 CN5 - JPL
2036, Feb 15	Aten NEA 2020 CL1 ($H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 9.21 LD. Minimum miss distance 9.19 LD. See: 2020 CL1 – S2P , 2020 CL1 – JPL See also: 15 Feb 1940, 15 Feb 1991, 14 Feb 2081, 16 Feb 2118.
2036, Mar 15	Apollo NEA 216985 (2000 QK130) , ($H = 21.3$ mag, $D \approx 200$ m, PHA) will pass Earth at a nominal miss distance of 4.44 LD. Minimum miss distance 4.44 LD. See: 2000 QK130 - JPL , 2000 QK130 - SSA See also: 12 Mar 1916, 14 Mar 1968, 15 Mar 2089.
2036, Mar 30	Apollo NEA 99942 Apophis (2004 MN4) , ($H = 19.7$ mag, $D = 310 \pm 30$ m, orbital $P = 0.89$ yr, PHA) will pass Earth at a nominal miss distance of 91.89 LD. Minimum miss distance 21.82 LD. See: 99942 Apophis - SSA , 2004 MN4 - JPL See also: http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2013-017 http://neo.jpl.nasa.gov/apophis/ https://cneos.jpl.nasa.gov/doc/apophis/ http://news.bbc.co.uk/2/hi/science/nature/8296796.stm http://www.scientificamerican.com/blog/post.cfm?id=planetary-bombardments-past-and-fut-2009-10-08 http://en.rian.ru/science/20110126/162318648.html http://www.space.com/10752-apophis-asteroid-hit-earth.html http://www.space.com/19221-asteroid-apophis-earth-safe-2036.html https://phys.org/news/2017-06-impact-threat-asteroid-apophis.html https://phys.org/news/2017-08-asteroid-apophis-chance-earth-expert.html http://en.wikipedia.org/wiki/99942_Apophis See also: 13 Apr 1907, 14 Apr 1949, 14 Apr 1998, 13 Apr 2029, 11 Sep 2102, 12 Apr 2116, 7 Apr 2123.
2036, Apr 2	Apollo NEA 2017 FU102 ($H = 29.0$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 0.34 LD. Minimum miss distance 0.26 LD. [2036-01]

	See: 2017 FU102 - SSA , 2017 FU102 - JPL
2037 , Mar 22	Aten NEA 2006 GB ($H = 20.2$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.10 LD. Minimum miss distance 4.10 LD. See: 2006 GB - JPL , 2006 GB - SSA See also: 22 Mar 1942 , 22 Mar 2081 .
2037, Nov 7	Apollo NEA 2020 VO1 ($H = 28.1$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 6.09 LD. Minimum miss distance 0.52 LD. See: 2020 VO1 – S2P , 2020 VO1 - JPL Discovery station: Pan-STARRS 2, Haleakala See also: 6 Nov 2020 .
2038 , Feb 11	Apollo NEA 2002 NY40 ($H = 19.3$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 2.84 LD. Minimum miss distance 2.83 LD. See: 2002 NY40 - SSA , 2002 NY40 - JPL See also: 18 Aug 2002 .
2038, Apr 21	Apollo NEA 2011 WL2 ($H = 21.0$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 4.70 LD. Minimum miss distance 4.70 LD. See: 2011 WL2 - JPL , 2011 WL2 - SSA See also: 25 Oct 2077 . See also: https://en.wikipedia.org/wiki/2011_WL2
2038, May 23	Amor NEA 1943 Anteros (1973 EC , $H = 15.9$ mag, $D \approx 2.48$ km) will pass Earth at a nominal miss distance of 25.84 LD. Minimum miss distance 25.84 LD. See: 1973 EC - SSA , 1973 EC - JPL See also: 13 Mar 1973 , 6 Feb 2015 , 20 May 2050 . See also: https://en.wikipedia.org/wiki/1943_Anteros
2039 , Feb 28	Apollo NEA 369057 (2008 DK5) , $H = 21.3$ mag, $D \approx 180$ m, PHA) will pass Earth at a nominal miss distance of 4.45 LD. Minimum miss distance 4.45 LD. See: 2008 DK5 - JPL , 2008 DK5 - SSA
2039, Apr 4	Apollo NEA 2019 OQ2 ($H = 20.4$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.83 LD. Minimum miss distance 4.82 LD. See: 2019 OQ2 – SSA , 2019 OQ2 – JPL
2039, May 7	Apollo NEA 2009 TD17 ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 4.33 LD. Minimum miss distance 0.05

	LD. See: 2009 TD17 - SSA , 2009 TD17 - JPL See also: 23 Apr 1992, 5 Oct 2009.
2039, May 12	Aten NEA 2020 JQ1 ($H = 26.0$ mag, $D \approx 22$ m) will pass Earth at a nominal miss distance of 1.58 LD. Minimum miss distance 0.53 LD. See: 2020 JQ1 – S2P , 2020 JQ1 – JPL See also: 11 May 1948, 12 May 1967.
2039, Nov 12	Aten NEA 2005 VN5 ($H = 27.1$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 5.44 LD. Minimum miss distance 0.36 LD. See: 2005 VN5 - SSA , 2005 VN5 - JPL
2040 , Feb 4	Apollo NEA 367789 (2011 AG5, $H = 22.0$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 2.78 LD. Minimum miss distance 2.57 LD. See: 367789 2011 AG5 - SSA , 2011 AG5 - JPL Ref: - S.R. Chesley, S. Bhaskaran, P.W. Chodas, et al., October 2012, American Astronomical Society, DPS meeting #44, #305.09, "Impact hazard assessment for 2011 AG5." See: http://adsabs.harvard.edu/abs/2012DPS....4430509C See also: http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2012-051 http://www.jpl.nasa.gov/news/news.cfm?release=2012-051 http://www.space.com/14683-big-asteroid-2011-ag5-threat-earth.html http://www.space.com/14782-asteroid-threat-earth-impact-2011ag5.html http://blogs.discovermagazine.com/badastronomy/files/2012/03/schweikart_letter_NASA_AG5.pdf http://www.space.com/14872-asteroid-2011-ag5-earth-impact.html http://www.space.com/16169-earth-safe-asteroid-2011ag5-flyby.html http://neo.jpl.nasa.gov/news/news176.html http://www.ifa.hawaii.edu/info/press-releases/allclear2011AG5.shtml http://www.space.com/19045-asteroid-earth-impact-2040-debunked.html http://en.wikipedia.org/wiki/2011_AG5 Workshop: 29 May 2012. See also: 26 Feb 2011, 3 Feb 2023.
2040, Feb 7	Apollo NEA 2013 VA10 ($H = 22.4$ mag, $D \approx 120$ m) will pass Earth at a nominal miss distance of 3.90 LD. Minimum miss distance 3.90 LD. See: 2013 VA10 – SSA , 2013 VA10 – JPL See also: 6 Feb 1944, 8 Feb 2161.
2041 , Apr 8	Apollo NEA 2012 UE34 ($H = 23.1$ mag, $D \approx 90$ m) will pass Earth at a nominal miss distance of 0.29 LD. Minimum miss distance 0.28 LD. [2041-01]

	See: 2012 UE34 - SSA , 2012 UE34 - JPL See also: 8 Apr 1991. See also: https://en.wikipedia.org/wiki/2012_UE34
2041, Apr 24	Apollo NEA 2018 HW1 ($H = 25.8$ mag, $D \approx 25$ m) will pass Earth at a nominal miss distance of 7.71 LD. Minimum miss distance 0.58 LD. See: 2018 HW1 - JPL , 2018 HW1 - SSA See also: 19 Apr 1975, 21 Apr 2018.
2041, May 15	Apollo NEA 2016 GD135 ($H = 20.9$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 4.69 LD. Minimum miss distance 4.65 LD. See: 2016 GD135 - JPL , 2016 GD135 - SSA
2041, Jul 24	Apollo NEA 2013 PG10 ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 6.04 LD. Minimum miss distance 0.64 LD. See: 2013 PG10 - SSA , 2013 PG10 - JPL See also: 25 Jul 1990.
2041, Oct 4	Apollo NEA 2008 QS11 ($H = 19.7$ mag, $D \approx 472$ m, PHA) will pass Earth at a nominal miss distance of 3.64 LD. Minimum miss distance 3.64 LD. See: 2008 QS11 - SSA , 2008 QS11 - JPL
2041, Nov 7	Apollo NEA 144898 (2004 VD17), $H = 19.0$ mag, $D \approx 320$ m, PHA) will pass Earth at a nominal miss distance of 5.09 LD. Minimum miss distance 5.09 LD. See: 144898 2004 VD17 - SSA , 2004 VD17 - JPL Ref: - F. de Luise, D. Perna, E. Dotto, et al., 2007, <i>Icarus</i>, 191, 628, "Physical investigation of the potentially hazardous asteroid (144898) 2004 VD17." See: http://adsabs.harvard.edu/abs/2007Icar..191..628D See also: http://www.thespacereview.com/article/581/2 http://en.wikipedia.org/wiki/(144898)_2004_VD17 See also: 7 May 2148, 5 May 2196.
2042, May 22	Asteroid 2017 KJ32 ($H = 29.2$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 0.90 LD. Minimum miss distance 0.88 LD. [2042-01] See: 2017 KJ32 - JPL , 2017 KJ32 - SSA See also: 18 May 1994.

2042, Jun 16	Aten NEA 513171 (2004 MD6) ($H = 20.2$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 3.78 LD. Minimum miss distance 3.78 LD. See: 2004 MD6 - JPL , 2004 MD6 - SSA
2042, Oct 2	Apollo NEA 2018 TP5 ($H = 25.7$ mag, $D \approx 25$ m) will pass Earth at a nominal miss distance of 2.11 LD. Minimum miss distance 0.32 LD. See: 2018 TP5 -JPL , 2018 TP5 - SSA
2042, Oct 30	Apollo NEA 2018 GE2 ($H = 27.0$ mag, $D \approx 14$ m) will pass Earth at a nominal miss distance of 0.36 LD. Minimum miss distance 0.28 LD. [2042-02] See: 2018 GE2 - SSA , 2018 GE2 - JPL
2043 , Jul 23	Apollo NEA 2018 AB12 ($H = 24.5$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 2.65 LD. Minimum miss distance 0.73 LD. See: 2018 AB12 - SSA , 2018 AB12 - JPL
2043, Aug 4	Apollo NEA 2020 NK1 ($H = 19.0$ mag, $D \approx 600$ m, PHA) will pass Earth at a nominal miss distance of 8.88 LD. Minimum miss distance 8.21 LD. See: 2020 NK1 – S2P , 2020 NK1 - JPL See also: 4 Aug 1969 .
2043, Sep 21	Apollo NEA 2019 SX ($H = 29.6$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 1.47 LD. Minimum miss distance 0.04 LD. See: 2019 SX – SSA , 2019 SX – JPL
2044 , Mar 18	Apollo NEA 2019 WL4 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 5.65 LD. Minimum miss distance 5.56 LD. See: 2019 WL4 – SSA , 2019 WL4 – JPL
2044, Jun 10	Aten NEA 2014 GQ17 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 2.02 LD. Minimum miss distance 0.07 LD. See: 2014 GQ17 - SSA , 2014 GQ17 - JPL
2044, Sep 17	Apollo NEA 2020 QL2 ($H = 23.6$ mag, $D \approx 70$ m) will pass Earth at a nominal miss distance of 1.04 LD. Minimum miss distance 0.99 LD. See: 2020 QL2 – S2P , 2020 QL2 - JPL
2044, Sep 27	Aten NEA 2011 TO ($H = 26.8$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 1.21 LD. Minimum miss distance 0.68 LD.

	See: 2011 TO - SSA , 2011 TO - JPL See also: 28 Sep 1980, 28 Sep 2011.
2045 , Jan 25	Apollo NEA 2018 BN6 ($H = 26.9$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 7.27 LD. Minimum miss distance 1.01 LD. See: 2018 BN6 - SSA , 2018 BN6 - JPL See also: 24 Jan 2018.
2045, Apr 18	Aten NEA 2019 KJ4 ($H = 27.3$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 3.72 LD. Minimum miss distance 0.57 LD. See: 2019 KJ4 - SSA , 2019 KJ4 - JPL .
2046 , Jan 29	Apollo NEA 2020 OP3 ($H = 20.8$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 4.87 LD. Minimum miss distance 4.86 LD. See: 2020 OP3 – S2P , 2020 OP3 - JPL See also: 29 Jan 1986, 28 Jan 2027.
2046, Feb 15	Aten NEA 367943 Duende (2012 DA14 , $H = 24.2$ mag, $D \approx 40 \times 20$ m) will pass Earth at a nominal miss distance of 5.80 LD. Minimum miss distance 5.77 LD. See: 367943 Duende - SSA , 2012 DA14 - JPL See also: http://en.wikipedia.org/wiki/2012_DA14 See also: 17 Feb 1918, 19 Aug 2004, 16 Feb 2012, 15 Feb 2013, 15 Feb 2087.
2046, Apr 3	Apollo NEA 267221 (2001 AD2 , $H = 19.7$ mag, $D \approx 562$ m, PHA) will pass Earth at a nominal miss distance of 4.37 LD. Minimum miss distance 4.37 LD. See: 2001 AD2 - JPL , 2001 AD2 - SSA See also: 5 Apr 2133, 6 Apr 2150.
2046, Jun 13	Apollo NEA 2000 LF3 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 2.69 LD. Minimum miss distance 2.66 LD. See: 2000 LF3 - JPL , 2000 LF3 - SSA
2046, Jul 21	Amor NEA 2003 SM84 ($H = 22.9$ mag, $D \approx 90$ m) will pass Earth at a nominal miss distance of 19.98 LD. Minimum miss distance 19.97 LD. This NEA is being considered by ESA as a candidate target for the Don Quijote mission to study the effects of impacting a spacecraft into an asteroid. Also possible target for NASA manned mission, with launch date 22 March 2046, and 180 day mission duration. See: 2003 SM84 - SSA , 2003 SM84 - JPL

	See also: http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/awst/2010/08/16/AW_08_16_2010_p30-247032.xml&headline=NASA%20Narrows%20Potential%20Asteroid%20List http://www.nasa.gov/pdf/474223main_Johnson_ExploreNOW.pdf http://en.wikipedia.org/wiki/2003_SM84
2046, Nov 25	Aten NEA 1994 WR12 ($H = 22.7$ mag, $D \approx 100$ m) will pass Earth at a nominal miss distance of 4.23 LD. Minimum miss distance 4.22 LD. See: 1994 WR12 - SSA , 1994 WR12 - JPL See also: 25 Nov 1994. See also: http://en.wikipedia.org/wiki/1994_WR12
2047, Jan 13	Apollo NEA 2010 WZ8 ($H = 20.9$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 4.17 LD. Minimum miss distance 4.17 LD. See: 2010 WZ8 - JPL , 2010 WZ8 - SSA See also: 13 Jan 1903.
2047, Feb 12	Apollo NEA 2012 HG2 ($H = 27.2$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 0.37 LD. Minimum miss distance 0.00012 LD (= 0.0071 R_{Earth} from the geocenter). [2047-01] See: 2012 HG2 - SSA , 2012 HG2 - JPL
2047, Apr 29	Aten NEA 2017 HW4 ($H = 22.0$ mag, $D \approx 140$ m) will pass Earth at a nominal miss distance of 4.51 LD. Minimum miss distance 4.49 LD. See: 2017 HW4 – SSA , 2017 HW4 – JPL
2047, Jun 5	Apollo NEA 2015 XJ351 ($H = 22.4$ mag, $D \approx 120$ m) will pass Earth at a nominal miss distance of 4.16 LD. Minimum miss distance 0.22 LD. See: 2015 XJ351 – S2P , 2015 XJ351 – JPL
2047, Jul 19	Apollo NEA 2021 AZ6 ($H = 26.3$ mag, $D \approx 19$ m) will pass Earth at a nominal miss distance of 0.93 LD. Minimum miss distance 0.74 LD. [2047-02] See: 2021 AZ6 – S2P , 2021 AZ6 – JPL
2047, Aug 14	Apollo NEA 2011 DS ($H = 26.8$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 9.17 LD. Minimum miss distance 0.82 LD. See: 2011 DS – SSA , 2011 DS – JPL

2047, Sep 4	Apollo NEA 2018 RR1 ($H = 30.0$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 1.73 LD. Minimum miss distance 0.87 LD. See: 2018 RR1 - SSA , 2018 RR1 - JPL See also: 3 Sep 2018 .
2047, Sep 5	Apollo NEA 2016 RD34 ($H = 27.6$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 0.27 LD. Minimum miss distance 0.26 LD. [2047-03] See: 2016 RD34 - SSA , 2016 RD34 - JPL
2047, Oct 21	Aten NEA 2020 UA ($H = 28.4$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 2.03 LD. Minimum miss distance 0.03 LD. See: 2020 UA – S2P , 2020 UA - JPL See also: 21 Oct 2020 .
2048 , Feb 28	Apollo NEA 162162 (1999 DB7) , $H = 20.2$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 2.54 LD. Minimum miss distance 2.54 LD. See: 1999 DB7 - JPL , 1999 DB7 - SSA
2048, May 1	Apollo NEA 2015 HQ171 ($H = 27.0$ mag, $D \approx 14$ m) will pass Earth at a nominal miss distance of 2.03 LD. Minimum miss distance 0.93 LD. See: 2015 HQ171- SSA , 2015 HQ171- JPL
2048, Jun 2	Apollo NEA 2007 VK184 ($H = 22.2$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 5.06 LD. Minimum miss distance 5.01 LD. See: 2007 VK184 - SSA , 2007 VK184 - JPL Ref: - B. Corbin, 2010, presented at the <i>61st International Astronautical Congress</i> , Prague (Czech Republic), 27 September - 1 October 2010, "Implementing advanced technologies and models to reduce uncertainty in a global, cost-effective asteroid mitigation system." See: http://www.spacegeneration.org/index.php/eventstopics/news/227-sgac-announces-the-winner-of-the-2010-move-an-asteroid-competition See also: http://www.spacegeneration.org/images/stories/Projects/NEO/Corbin_Asteroid_Paper.pdf http://neo.jpl.nasa.gov/news/news183.html http://neo.jpl.nasa.gov/risk/2007vk184.html http://www.oosa.unvienna.org/pdf/pres/stsc2011/tech-42.pdf http://en.wikipedia.org/wiki/2007_VK184 See also: 6 Nov 2007 , 6 Jun 2118 .
2048, Oct 18	Apollo NEA 2007 UD6 ($H = 28.2$ mag, $D \approx 8$ m) will pass Earth at a

	nominal miss distance of 0.22 LD. Minimum miss distance 0.09 LD. [2048-01] See: 2007 UD6 - SSA , 2007 UD6 - JPL See also: 18 Oct 2007 .
2049 , Feb 20	Apollo NEA 2012 DY13 ($H = 28.1$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 2.63 LD. Minimum miss distance 0.29 LD. See: 2012 DY13 - SSA , 2012 DY13 - JPL
2049, Nov 12	Apollo NEA 2004 VM24 ($H = 25.5$ mag, $D \approx 28$ m) will pass Earth at a nominal miss distance of 2.40 LD. Minimum miss distance 0.18 LD. See: 2004 VM24 - SSA , 2004 VM24 - JPL
2049, Dec 25	Apollo NEA 450293 (2004 LV3) , $H = 19.1$ mag, $D \approx 500$ m, PHA) will pass Earth at 4.52 LD. Minimum miss distance 4.52 LD. See: 2004 LV3 - JPL , 2004 LV3 - SSA See also: 24 Dec 1952 .
2050 , Feb 18	Apollo NEA 2011 DS ($H = 26.8$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 6.91 LD. Minimum miss distance 0.54 LD. See: 2011 DS - SSA , 2011 DS - JPL See also: 14 Aug 1901 , 18 Feb 1966 .
2050, Feb 21, 13:04	Aten NEA 2021 DA2 ($H = 29.1$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 0.30 LD. Minimum miss distance 0.29 LD. [2050-01] See: 2021 DA2 – S2P , 2021 DA2 – JPL See also: 22 Feb 1955 , 21 Feb 2021 .
2050, Feb 21	Apollo NEA 2020 QN4 ($H = 28.6$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 4.94 LD. Minimum miss distance 0.46 LD. See: 2020 QN4 – S2P , 2020 QN4 - JPL See also: 16 Feb 2006 , 21 Aug 2020 .
2050, Feb 28	Aten NEA 2021 ER ($H = 27.0$ mag, $D \approx 14$ m) will pass Earth at a nominal miss distance of 5.53 LD. Minimum miss distance 0.15 LD. See: 2021 ER – S2P , 2021 ER - JPL
2050, Oct 9	Apollo NEA 2006 GU2 ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 1.04 LD. Minimum miss distance 0.44 LD. See: 2006 GU2– S2P , 2006 GU2– JPL
2050, Oct 15	Apollo NEA 2021 TM14 ($H = 28.0$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 3.21 LD. Minimum miss distance 0.50 LD.

	See: 2021 TM14 – S2P , 2021 TM14 - JPL See also: 14 Oct 2021 .
2050, Nov 5	Apollo NEA 2015 JJ ($H = 22.3$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 1.07 LD. Minimum miss distance 1.07 LD. See : 2015 JJ - SSA , 2015 JJ - JPL See also: 4 Nov 1989 , 6 Nov 2110 .
2051 , Jan 5	Apollo NEA 2018 BM3 ($H = 22.0$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 1.56 LD. Minimum miss distance 1.42 LD. See: 2018 BM3 - JPL , 2018 BM3 - SSA See also: 5 Jan 1979 .
2051, Mar 24	Apollo NEA 4581 Asclepius (1989 FC , $H = 20.9$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 4.78 LD. Minimum miss distance 4.78 LD. See: 4581 Asclepius - SSA , 1989 FC - JPL See also: 22 Mar 1989 , 16 Aug 2012 . See also: http://en.wikipedia.org/wiki/4581_Asclepius
2051, Aug 11	Apollo NEA 162422 (2000 EV70) ($H = 20.7$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 4.79 LD. Minimum miss distance 4.78 LD. See: 2000 EV70 - JPL , 2000 EV70 - SSA See also: https://en.wikipedia.org/wiki/(162421)_2000_ET70
2051, Oct 25	Apollo NEA 497117 (2004 FU4) , $H = 18.4$ mag, $D \approx 700$ m, PHA) will pass Earth at 3.17 LD. Minimum miss distance 3.16 LD. See: 2004 FU4 - JPL , 2004 FU4 - SSA
2052 , Mar 19	Apollo NEA 221455 (2006 BC10) , $H = 19.4$ mag, $D \approx 500$ m, PHA) will pass Earth at 3.05 LD. Minimum miss distance 3.04 LD. See: 2006 BC10 - JPL , 2006 BC10 - SSA
2052, Mar 22	Apollo NEA 231937 (2001 FO32) , $H = 17.6$ mag, $D \approx 1100$ m, PHA) will pass Earth at a nominal miss distance of 7.37 LD. Minimum miss distance 7.37 LD. See: 2001 FO32 – S2P , 2001 FO32 – JPL But, NEOWISE : $D \approx 440 - 680$ m. See: http://neo.ssa.esa.int/newsletters [March 2021] https://www.jpl.nasa.gov/news/asteroid-2001-fo32-will-safely-pass-by-earth-march-21 See also: 21 Mar 2021 , 23 Mar 2103 .

2052, May 13	Aten NEA 2018 JL1 ($H = 26.8$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 4.35 LD. Minimum miss distance 0.82 LD. See: 2018 JL1 - SSA , 2018 JL1 - JPL
2052, May 16	Aten NEA 2021 JY3 ($H = 28.4$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 1.03 LD. Minimum miss distance 0.66 LD. See: 2021 JZ5 – S2P , 2021 JZ5 - JPL See also: 20 May 1971 , 8 May 2059 .
2052, Nov 13	Aten NEA 2018 WR ($H = 26.2$ mag, $D \approx 20$ m) will pass Earth at a nominal miss distance of 0.72 LD. Minimum miss distance 0.59 LD. [2052-01] See: 2018 WR - SSA , 2018 WR - JPL
2052, Nov 30	Apollo NEA 2020 KS ($H = 25.7$ mag, $D \approx 26$ m) will pass Earth at a nominal miss distance of 2.05 LD. Minimum miss distance 0.31 LD. See: 2020 KS – S2P , 2020 KS – JPL See also: 28 Nov 1984 .
2053 , Feb 14	Aten NEA 2016 DB ($H = 28.7$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 5.48 LD. Minimum miss distance 0.49 LD. See: 2016 DB - SSA , 2016 DB - JPL
2053, Mar 23	Apollo NEA 2020 SK4 ($H = 30.4$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 3.45 LD. Minimum miss distance 0.56 LD. See: 2020 SK4 – S2P , 2020 SK4 - JPL
2053, Apr 28	Apollo NEA 2018 JN ($H = 25.1$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 3.51 LD. Minimum miss distance 0.04 LD. See: 2018 JN – SSA , 2018 JN – JPL
2053, Jun 1	Apollo NEA 2015 XA378 ($H = 25.9$ mag, $D \approx 23$ m) will pass Earth at a nominal miss distance of 0.54 LD. Minimum miss distance 0.22 LD. [2053-01] See: 2015 XA378 - SSA , 2015 XA378 - JPL See also: 16 Dec 1968 .
2053, Sep 30	Apollo NEA 360191 (1988 TA , $H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 2.22 LD. Minimum miss distance 2.22 LD. See: 1988 TA - JPL , 1988 TA - SSA See also: 29 Sep 1988 , 3 Oct 2189 .
2054 , Feb 5	Aten NEA 2016 CG18 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a

	nominal miss distance of 3.85 LD. Minimum miss distance 0.0074 LD (= 0.44 REarth from the geocenter). See: 2016 CG18- SSA , 2016 CG18- JPL See also: 6 Feb 2016, 3 Feb 2055.
2054, Feb 13	Apollo NEA 2021 CA6 ($H = 28.6$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 8.74 LD. Minimum miss distance 0.08 LD. See: 2021 CA6 – S2P , 2021 CA6 – JPL See also: 14 Feb 1936, 13 Feb 2021.
2054, Jul 12	Amor NEA 2020 UQ4 ($H = 20.2$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.48 LD. Minimum miss distance 2.65 LD. See: 2020 UQ4 – S2P , 2020 UQ4 - JPL
2054, Jul 13	Apollo NEA 2013 LM31 ($H = 20.6$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 2.48 LD. Minimum miss distance 1.60 LD. See: 2013 LM31 - JPL , 2013 LM31 - SSA
2054, Dec 10	Apollo NEA 2021 JE1 ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 0.28 LD. Minimum miss distance 0.21 LD. [2054-01] See: 2021 JE1 – S2P , 2021 JE1 - JPL
2055, Jan 1	Aten NEA 2009 YR ($H = 28.2$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 5.72 LD. Minimum miss distance 0.69 LD. See: 2009 YR - SSA , 2009 YR - JPL
2055, Jan 9	Asteroid 2019 AS5 ($H = 32.3$ mag, $D \approx 1.2$ m) will pass Earth at a nominal miss distance of 5.66 LD. Minimum miss distance 0.92 LD. See: 2019 AS5 - SSA , 2019 AS5 - JPL See also: 8 Jan 2019.
2055, Jan 15	Apollo NEA 2020 AN3 ($H = 20.4$ mag, $D \approx 290$ m, PHA) will pass Earth at a nominal miss distance of 3.23 LD. Minimum miss distance 3.15 LD. See: 2020 AN3 – S2P , 2020 AN3 – JPL See also: 17 Jan 2020
2055, Mar 5	Apollo NEA 2021 QW ($H = 23.3$ mag, $D \approx 80$ m) will pass Earth at a nominal miss distance of 7.02 LD. Minimum miss distance 0.17 LD. See: 2021 QW – S2P , 2021 QW – JPL
2055, May 13	Aten NEA 2011 AX22 ($H = 24.9$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 1.14 LD. Minimum miss distance 0.83 LD. See: 2011 AX22 - SSA , 2011 AX22 - JPL

	See also: 13 May 1930 .
2055, May 24	Apollo NEA 2015 YJ ($H = 28.2$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 4.18 LD. Minimum miss distance 0.27 LD. See: 2015 YJ - SSA , 2015 YJ - JPL See also: 13 Dec 2015 .
2055, Jun 29	Apollo NEA 2018 NL ($H = 25.5$ mag, $D \approx 29$ m) will pass Earth at a nominal miss distance of 0.55 LD. Minimum miss distance 0.13 LD. [2055-01] See: 2018 NL - SSA , 2018 NL - JPL
2056 , Feb 5	Aten NEA 2016 CE ($H = 28.7$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 2.66 LD. Minimum miss distance 0.15 LD. See: 2016 CE - SSA , 2016 CE - JPL See also: 5 Feb 1971 .
2056, Apr 26	Apollo NEA 2019 TK5 ($H = 27.3$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 0.73 LD. Minimum miss distance 0.39 LD. [2056-01] See: 2019 TK5 - SSA , 2019 TK5 - JPL
2056, Jul 21	Apollo NEA 2016 BA15 ($H = 27.0$ mag, $D \approx 14$ m) will pass Earth at a nominal miss distance of 13.9 LD. Minimum miss distance 0.06 LD (= 3.3 R_{Earth} from the geocenter). See: 2016 BA15 - JPL , 2016 BA15 - SSA See also: 19 Jul 1945 .
2056, Sep 4	Aten NEA 2018 RW ($H = 30.5$ mag, $D \approx 2.8$ m) will pass Earth at a nominal miss distance of 9.37 LD. Minimum miss distance 0.66 LD. See: 2018 RW - SSA , 2018 RW - JPL
2057 , Apr 29	Apollo NEA 2014 UU56 ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 8.78 LD. Minimum miss distance 0.57 LD. See: 2014 UU56 - SSA , 2014 UU56 - JPL
2057, Sep 2	Amor NEA 3122 Florence (1981 ET3 , $H = 13.8$ mag, $D \approx 4350$ m, PHA) will pass Earth at a nominal miss distance of 19.442 LD. Minimum miss distance 19.442 LD. See: 3122 Florence - SSA , 1981 ET3 - JPL See also: 1 Sep 2017 . See also: https://en.wikipedia.org/wiki/3122_Florence

2057, Oct 12	Apollo NEA 162120 (1998 SH36) , $H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 4.49 LD. Minimum miss distance 4.49 LD. See: 1998 SH36 - JPL , 1998 SH36 - SSA
2058 , Feb 11	Aten NEA 2009 BE58 ($H = 21.8$ mag, $D \approx 150$ m, PHA) will pass Earth at a nominal miss distance of 4.84 LD. Minimum miss distance 4.83 LD. See: 2009 BE58 - JPL , 2009 BE58 - SSA See also: 10 Feb 1950 , 13 Feb 2194 .
2058, Apr 21	Apollo NEA 2019 HE ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 7.94 LD. Minimum miss distance 0.63 LD. See: 2019 HE - SSA , 2019 HE - JPL See also: 20 Apr 2019 .
2058, May 8	Apollo NEA 2018 VO6 ($H = 24.3$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 8.94 LD. Minimum miss distance 0.13 LD See: 2007 VO6 - SSA , 2007 VO6 - JPL See also: 7 May 1977 , 8 May 2063 .
2058, Jun 5	Apollo NEA 4953 (1990 MU) , $H = 15.2$ mag, $D \approx 2800$ m, PHA) will pass Earth at a nominal miss distance of 8.99 LD. Minimum miss distance 8.99 LD. See: 4953 1990 MU - SSA , 1990 MU - JPL See also: http://en.wikipedia.org/wiki/(4953)_1990_MU See also: 6 Jun 2027
2058, Sep 22	Apollo NEA 523809 (2007 TV18) , $H = 23.8$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.92 LD. [2058-01] See: 2007 TV18 - SSA , 2007 TV18 - JPL
2058, Nov 7	Apollo NEA 525484 (2005 GL) ($H = 21.0$ mag, $D \approx 220$ m, PHA) will pass Earth at a nominal miss distance of 4.13 LD. Minimum miss distance 4.12 LD. See: 2005 GL - JPL , 2005 GL - SSA See also: 8 Nov 2125 .
2058, Nov 20	Apollo NEA 2015 WP2 ($H = 30.1$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 3.16 LD. Minimum miss distance 0.10 LD. See: 2015 WP2 - SSA , 2015 WP2 - JPL
2059 , Feb 24	Aten NEA 2020 DR4 ($H = 29.7$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 4.87 LD. Minimum miss distance 0.28 LD.

	See: 2020 DR4 – S2P , 2020 DR4 - JPL See also: 25 Feb 2020 .
2059, Mar 22	Apollo NEA 2014 FA7 ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 8.59 LD. Minimum miss distance 0.90 LD. See: 2014 FA7 – S2P , 2014 FA7 – JPL
2059, May 8	Aten NEA 2021 JY3 ($H = 28.4$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 4.86 LD. Minimum miss distance 0.61 LD. See: 2021 JZ5 – S2P , 2021 JZ5 - JPL See also: 20 May 1971 , 16 May 2052 .
2059, May 21	Apollo NEA 2012 WS3 ($H = 26.1$ mag, $D \approx 21$ m) will pass Earth at a nominal miss distance of 2.12 LD. Minimum miss distance 0.34 LD. See: 2012 WS3 - SSA , 2012 WS3 - JPL
2059, Sep 25	Aten NEA 2008 ST ($H = 27.1$ mag, $D \approx 14$ m) will pass Earth at a nominal miss distance of 4.13 LD. Minimum miss distance 0.47 LD. See: 2008 ST – S2P , 2008 ST – JPL
2059, Oct 2	Apollo NEA 2016 JA ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 1.41 LD. Minimum miss distance 0.81 LD. See: 2016 JA - SSA , 2016 JA - JPL See also: 1 Oct 2060 .
2059, Nov 1	Aten NEA 2010 UJ7 ($H = 25.6$ mag, $D \approx 27$ m) will pass Earth at a nominal miss distance of 3.85 LD. Minimum miss distance 0.55 LD. See: 2010 UJ7 - SSA , 2010 UJ7 - JPL
2059, Nov 23	Apollo NEA 529366 (2009 WM1) , $H = 20.4$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 1.82 LD. Minimum miss distance 1.82 LD. See: 2009 WM1 - SSA , 2009 WM1 - JPL See also: http://en.wikipedia.org/wiki/2009_WM1
2059, Dec 14	Aten NEA 2004 YC ($H = 25.9$ mag, $D \approx 23$ m) will pass Earth at a nominal miss distance of 3.02 LD. Minimum miss distance 0.87 LD. See: 2004 YC - SSA , 2004 YC - JPL
2059, Dec 28	Aten NEA 2010 XC15 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 4.96 LD. Minimum miss distance 4.87 LD. See: 2010 XC15 - JPL , 2010 XC15 - SSA

	See also: https://en.wikipedia.org/wiki/2010_XC15 See also: 26 Dec 1907, 27 Dec 1914, 27 Dec 1976, 27 Dec 2022, 26 Dec 2064, 26 Dec 2096.
2060, Jan 30	Aten NEA 2019 BE5 ($H = 25.1$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 0.99 LD. Minimum miss distance 0.99 LD. [2060-01] See: 2019 BE5 – SSA , 2019 BE5 – JPL See also: 29 Jan 2079.
2060, Feb 14	Apollo NEA 4660 Nereus (1982 DB, $H = 18.5$ mag, $D \approx 510 \times 330 \times 240$ m, PHA) will pass Earth at 3.12 LD. Minimum miss distance 3.12 LD. See: 4660 Nereus - SSA , 1982 DB - JPL Ref: - M. Brozovic, S.J. Ostro, L.A.M. Benner, et al., 2009, <i>Icarus</i>, 201, 153, "Radar observations and a physical model of asteroid 4660 Nereus, a prime space mission target." See: http://adsabs.harvard.edu/abs/2009Icar..201..153B See also: 29 Jan 1900, 22 Jan 2002, 11 Dec 2021, 4 Feb 2071, 23 Dec 2112, 4 Feb 2166. See also: http://en.wikipedia.org/wiki/4660_Nereus
2060, Mar 30	Apollo NEA 2014 TL ($H = 28.0$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 5.59 LD. Minimum miss distance 0.65 LD. See: 2014 TL - SSA , 2014 TL - JPL See also: 1 Oct 2014.
2060, April 21	Apollo NEA 2018 HV ($H = 28.8$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 9.73 LD. Minimum miss distance 0.29 LD. See: 2018 HV – S2P , 2018 HV – JPL
2060, Apr 23	Apollo NEA 2017 KN34 ($H = 19.8$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 2.71 LD. Minimum miss distance 2.71 LD. See: 2017 KN34 – SSA , 2017 KN34 - JPL
2060, Sep 23	Apollo NEA 101955 Bennu, (1999 RQ36, $H = 20.2$ mag, $D = 492$ m, PHA) will pass Earth at a nominal miss distance of 1.949 LD. Minimum miss distance 1.949 LD. Possible Earth impact in 2182. See: 101955 Bennu - SSA , 1999 RQ36 - JPL Ref: - A. Milani, S.R. Chesley, M.E. Sansaturio, et al., 2009, <i>Icarus</i>, 203, 460, "Long term impact risk for (101955) 1999 RQ36." See: http://adsabs.harvard.edu/abs/2009Icar..203..460M

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2060, Oct 1	Apollo NEA 2016 JA ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 5.66 LD. Minimum miss distance 0.18 LD. See: 2016 JA - SSA , 2016 JA - JPL See also: 2 Oct 2059.
2060, Oct 30	Apollo NEA 2017 VJ ($H = 24.5$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 2.57 LD. Minimum miss distance 0.48 LD. See: 2017 VJ - SSA , 2017 VJ - JPL
2061 , Jan 17	Apollo NEA 2012 YQ1 ($H = 21.2$ mag, $D \approx 200$ m, PHA) will pass Earth at a nominal miss distance of 4.14 LD. Minimum miss distance 2.16 LD. See: 2012 YQ1 - JPL , 2012 YQ1 - SSA See also: https://en.wikipedia.org/wiki/2012_YQ1
2061, Feb 12	Apollo NEA 2017 CP32 ($H = 23.8$ mag, $D \approx 60$ m) will pass Earth at

	a nominal miss distance of 3.19 Minimum miss distance 0.73 LD. See: 2017 CP32 - SSA , 2017 CP32 - JPL See also: 12 Feb 1974 .
2061, Feb 16	Aten NEA 2010 CK19 ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 9.11. Minimum miss distance 0.39 LD. See: 2010 CK19 - SSA , 2010 CK19 - JPL
2061, April 4	Apollo NEA 2020 GC1 ($H = 25.2$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 8.34 LD. Minimum miss distance 0.33 LD. See: 2020 GC1 – S2P , 2020 GC1 – JPL
2061, Dec 14	Apollo NEA 2016 WJ1 ($H = 21.4$ mag, $D \approx 180$ m, PHA) will pass Earth at a nominal miss distance of 1.59 Minimum miss distance 1.59 LD. See: 2016 WJ1 - SSA , 2016 WJ1 - JPL See also: 13 Dec 1920 , 14 Dec 2097 .
2061, Dec 19	Apollo NEA 2019 YV1 ($H = 25.2$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 0.83. Minimum miss distance 0.67 LD. [2061-01] See: 2019 YV1 – SSA , 2019 YV1 – JPL
2062 , Mar 30	Apollo NEA 2014 GY44 ($H = 25.7$ mag, $D \approx 26$ m) will pass Earth at a nominal miss distance of 0.91. Minimum miss distance 0.89 LD. [2062-01] See: 2014 GY44 - SSA , 2014 GY44 - JPL
2062, Mar 31	Aten NEA 2020 VA4 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 4.42. Minimum miss distance 0.88 LD. See: 2020 VA4 – S2P , 2020 VA4 – JPL
2062, Apr 23	Apollo NEA 2007 VG ($H = 21.4$ mag, $D \approx 190$ m, PHA) will pass Earth at a nominal miss distance of 3.53 LD. Minimum miss distance 3.53 LD. See: 2007 VG - SSA , 2007 VG - JPL See also: 24 Apr 1903 .
2062, Jul 27	Aten NEA 2021 OC1 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 2.33 LD. Minimum miss distance 0.54 LD. See: 2021 OD1 – S2P , 2021 OD1 - JPL See also: 29 Jul 1983 , 26 Jul 2034 .
2062, Oct 7	Apollo NEA 2021 TQ4 ($H = 29.9$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 3.83LD. Minimum miss distance 0.70 LD.

	See: 2021 TQ4 – S2P , 2021 TQ4 - JPL See also: 6 Oct 2021 .
2062, Oct 20	Apollo NEA 65803 Didymos (1996 GT , $H = 18.1$ mag, $D \approx 780 + 160$ m, PHA) will pass Earth at 19.32 LD (= 0.05 AU). Minimum miss distance 19.32 LD. Flyby target for AIDA mission. See: 65803 Didymos - SSA , 1996 GT - JPL See also: https://en.wikipedia.org/wiki/65803_Didymos See also: 12 Nov 2003 , 29 May 2012 , 4 Oct 2022 , 4 Nov 2123 .
2062, Nov 30	Apollo NEA 2015 XG55 ($H = 27.7$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 3.79 LD. Minimum miss distance 0.74 LD. See: 2015 XG55 – S2P , 2015 XG55 – JPL
2063 , Mar 11	Apollo NEA 2006 EC ($H = 26.5$ mag, $D \approx 18$ m) will pass Earth at a nominal miss distance of 8.68. Minimum miss distance 0.71 LD. See: 2006 EC - SSA , 2006 EC - JPL See also: 8 Mar 2006 .
2063, Mar 26	Apollo NEA 2018 EM4 ($H = 25.3$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 7.30 LD. Minimum miss distance 0.70 LD. See: 2018 EM4 - JPL , 2018 EM4 - SSA See also: 27 Mar 1943 .
2063, May 8	Apollo NEA 2018 VO6 ($H = 24.3$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 3.49 LD. Minimum miss distance 0.11 LD. See: 2007 VO6 - SSA , 2007 VO6 - JPL See also: 7 May 1977 .
2063, Jul 27	Apollo NEA 2015 CV13 ($H = 20.6$ mag, $D \approx 270$ m, PHA) will pass Earth at a nominal miss distance of 3.93 LD. Minimum miss distance 3.93 LD. See: 2015 CV13 - SSA , 2015 CV13 - JPL
2063, Nov 21	Apollo NEA 2009 WJ6 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 3.74 LD. Minimum miss distance 0.26 LD. See: 2009 WJ6 - SSA , 2009 WJ6 - JPL
2064 , Mar 2	Aten NEA 2018 DU1 ($H = 27.6$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 2.76. Minimum miss distance 0.18 LD. See: 2018 DU1 - SSA , 2018 DU1 - JPL

2064, Mar 31	Aten NEA 2021 FW2 ($H = 25.4$ mag, $D \approx 30$ m) passed Earth at a nominal miss distance of 2.86 LD. Minimum miss distance 0.48 LD. See: 2021 FW2 – S2P , 2021 FW2 – JPL See also: 31 Mar 2006 .
2064, Jul 27	Apollo NEA 2021 BN , $H = 28.3$ mag, $D \approx 8$ m will pass Earth at a nominal miss distance of 4.00 LD. Minimum miss distance 0.56 LD. See: 2021 BN – S2P , 2021 BN – JPL See also: 21 Jul 1977 .
2064, Aug 2	Apollo NEA 2019 BV2 ($H = 25.6$ mag, $D \approx 27$ m) will pass Earth at a nominal miss distance of 2.87 LD. Minimum miss distance 0.39 LD. See: 2019 BV2 - JPL , 2019 BV2 - SSA See also: 26 Jan 2016 , 2 Aug 2064 .
2064, Sep 10	Apollo NEA 2021 RR5 ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 7.40 LD. Minimum miss distance 0.0043 LD (= 0.26 R_{Earth} from the geocenter) . See: 2021 RR5 – S2P , 2021 RR5 - JPL See also: 12 Sep 2021 .
2064, Oct 12	Aten NEA 2015 TG24 ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 1.92. Minimum miss distance 0.69 LD. See: 2015 TG24 - SSA , 2015 TG24 - JPL
2064, Oct 19	Apollo NEA 2019 UE4 ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 6.83. Minimum miss distance 0.19 LD. See: 2019 UE4 – SSA , 2019 UE4 – JPL See also: 21 Oct 2008 .
2064, Oct 28	Apollo NEA 2016 UE57 ($H = 26.4$ mag, $D \approx 19$ m) will pass Earth at a nominal miss distance of 3.17 LD. Minimum miss distance 0.56 LD. See: 2018 HV – S2P , 2018 HV – JPL
2064, Dec 20	Aten NEA 2017 YO3 ($H = 28.2$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 2.38 LD. Minimum miss distance 0.013 LD (= 0.76 R_{earth} from the geocenter) . See: 2017 YO3 - JPL , 2017 YO3 - SSA See also: 19 Dec 1973 .
2064, Dec 26	Aten NEA 2010 XC15 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 3.47 LD. Minimum miss distance 3.27 LD.

	See: 2010 XC15 - SSA , 2010 XC15 - JPL See also: https://en.wikipedia.org/wiki/2010_XC15 See also: 26 Dec 1907, 27 Dec 1914, 27 Dec 1976, 27 Dec 2022, 28 Dec 2059, 26 Dec 2096.
2065, Feb 12	Apollo NEA 2016 CB248 ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 9.73 LD. Minimum miss distance 0.29 LD. See: 2016 CB248 - S2P , 2016 CB248 - JPL
2065, Mar 4	Apollo NEA 2014 EG45 ($H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 4.66 LD. Minimum miss distance 4.63 LD. See: 2014 EG45 - SSA , 2014 EG45 - JPL See also: 4 Mar 2014, 6 Mar 2128.
2065, May 28	Apollo NEA 2005 WY55 ($H = 20.6$ mag, $D \approx 270$ m, PHA) will pass Earth at a nominal miss distance of 0.87 LD. Minimum miss distance 0.86 LD. [2065-01] See: 2005 WY55 - SSA , 2005 WY55 - JPL See also: http://en.wikipedia.org/wiki/2005_WY55
2065, Jun 8	Aten NEA 2014 HQ124 ($H = 19.0$ mag, $D \approx 410$ m, PHA) will pass Earth at a nominal miss distance of 7.61 LD. Minimum miss distance 7.61 LD. See: 2014 HQ124 - SSA , 2014 HQ124 - JPL See also: http://www.jpl.nasa.gov/news/news.php?release=2014-178 http://www.jpl.nasa.gov/news/news.php?release=2014-186 http://www.jpl.nasa.gov/video/index.php?id=1310 https://en.wikipedia.org/wiki/2014_HQ124 See also: 7 Jun 1901, 7 Jun 1952, 8 Jun 2014.
2065, Oct 15	Apollo NEA 2018 GD2 ($H = 29.5$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 4.59 LD. Minimum miss distance 0.57 LD. See: 2018 GD2 - SSA , 2018 GD2 - JPL See also: 13 Apr 2005, 12 Apr 2018.
2065, Oct 17	Aten NEA 2013 UG1 ($H = 22.5$ mag, $D \approx 110$ m), will pass Earth at a nominal miss distance of 2.83 LD. Minimum miss distance 2.83 LD. See: 2013 UG1 - SSA , 2013 UG1 - JPL See also: http://rt.com/news/asteroid-potentially-hazardous-earth-695/

	See also: 17 Oct 1976 .
2066 , Feb 6	Apollo NEA 2008 CE22 ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 0.75 LD. Minimum miss distance 0.52 LD. [2066-01] See: 2008 CE22 - SSA , 2008 CE22 - JPL See also: 6 Feb 2008 .
2066, Mar 1	Aten NEA 2019 ED1 ($H = 27.7$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 1.83 LD. Minimum miss distance 0.05 LD. See: 2019 ED1 - SSA , 2019 ED1 - JPL See also: 1 Mar 2019 .
2066, Apr 16	Apollo NEA 2004 RQ252 ($H = 22.5$ mag, $D \approx 110$ m) will pass Earth at a nominal miss distance of 1.70 LD. Minimum miss distance 0.53 LD. See: 2004 RQ252 - SSA , 2004 RQ252 - JPL
2066, Aug 1	Aten NEA 2021 OD1 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 3.60 LD. Minimum miss distance 0.87 LD. See: 2021 OD1 - S2P , 2021 OD1 - JPL See also: 31 Jul 1985 , 31 Jul 2021 .
2066, Aug 22	Apollo NEA 2013 QM48 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 5.46 LD. Minimum miss distance 0.47 LD. See: 2013 QM48 - S2P , 2013 QM48 - JPL
2066, Sep 23	Apollo NEA 523654 (2011 SR5 , $H = 20.8$ mag, $D \approx 250$ m, PHA) will pass Earth at a nominal miss distance of 1.24 LD. Minimum miss distance 1.23 LD. See: 2011 SR5 - SSA , 2011 SR5 - JPL See also: 22 Sep 1988 .
2066, Sep 25	Apollo NEA 2017 SS12 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 4.55 LD. Minimum miss distance 0.06 LD. See: 2017 SS12 - SSA , 2017 SS12 - JPL See also: 24 Sep 2017 .
2066, Dec 15	Aten NEA 487577 (2014 YQ15 , $H = 20.9$ mag, $D \approx 240$ m, PHA) will pass Earth at a nominal miss distance of 4.92 LD. Minimum miss distance 4.90 LD. See: 2014 YQ15 - SSA , 2014 YQ15 - JPL See also: 15 Dec 1959 , 16 Dec 2122 .

2067, Mar 3	Apollo NEA 2009 DD45 ($H = 25.9$ mag, $D \approx 19$ m) will pass Earth at a nominal miss distance of 1.38 LD. Minimum miss distance 0.28 LD. See: 2009 DD45 - SSA , 2009 DD45 - JPL See also: http://en.wikipedia.org/wiki/2009_DD45 See also: 2 Mar 2009.
2067, Mar 6	Apollo NEA 410627 (2008 RG1, $H = 21.0$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 4.70 LD. Minimum miss distance 4.70 LD. See: 2008 RG1 - SSA , 2008 RG1 - JPL
2067, Sep 10	Apollo NEA 387668 (2002 SZ, $H = 20.4$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 3.77 LD. Minimum miss distance 3.77 LD. See: 2002 SZ - SSA , 2002 SZ - JPL See also: 10 Sep 2150.
2067, Sep 24	Apollo NEA 2016 SA2 ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 3.11 LD. Minimum miss distance 0.24 LD. See: 2016 SA2 - SSA , 2016 SA2 - JPL See also: 25 Sep 2016.
2067, Nov 26	Apollo NEA 2013 NJ ($H = 22.1$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 2.80 LD. Minimum miss distance 2.80 LD. See: 2013 NJ - SSA , 2013 NJ - JPL See also: 24 Nov 1956, 24 Nov 1997, 26 Nov 2013.
2068, Jan 19	Aten NEA 2018 BX ($H = 28.8$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 1.10 LD. Minimum miss distance 0.996 LD. See: 2018 BX - SSA , 2018 BX - JPL See also: 19 Jan 2018.
2068, Jan 24	Apollo NEA 2019 EH ($H = 24.7$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 6.55 LD. Minimum miss distance 0.83 LD. See: 2019 EH - SSA , 2019 EH - JPL
2068, Feb 10	Apollo NEA 2016 TA11 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 3.55 LD. Minimum miss distance 0.92 LD. See: 2016 TA11 - SSA , 2016 TA11 - JPL

2068, Mar 11	Apollo NEA 2016 CY135 ($H = 24.5$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 2.79 LD. Minimum miss distance 0.81 LD. See: 2016 CY135 - SSA , 2016 CY135 - JPL See also: 9 Mar 1914.
2068, Oct 17	Apollo NEA 2021 UL ($H = 30.3$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 3.35 LD. Minimum miss distance 0.29 LD. See: 2021 UL – S2P , 2021 UL – JPL See also: 16 Oct 2021.
2068, Oct 19	Aten NEA 2020 UO4 ($H = 28.7$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 4.32 LD. Minimum miss distance 0.72 LD. See: 2020 UO4 – S2P , 2020 UO4 – JPL See also: 23 Oct 1957.
2069 , Jan 9	Aten NEA 2017 AG13 ($H = 26.0$ mag, $D \approx 22$ m) will pass Earth at a nominal miss distance of 6.64 LD. Minimum miss distance 0.43 LD. See: 2017 AG13 - SSA , 2017 AG13 - JPL See also: http://www.astronomy.com/news/2017/01/aten-asteroid-close-to-earth https://en.wikipedia.org/wiki/2017_AG13 See also: 9 Jan 2017.
2069, Feb 28	Aten NEA 2019 EM1 ($H = 22.2$ mag, $D \approx 110$ m) will pass Earth at a nominal miss distance of 2.75 LD. Minimum miss distance 2.06 LD. See: 2019 EM1 - JPL , 2019 EM1 - SSA See also: 2 Mar 2114.
2069, Oct 21	Aten NEA 2340 Hathor (1976 UA, $H = 20.5$ mag, $D \approx 210$ m, PHA) will pass Earth at a nominal miss distance of 2.55 LD. Minimum miss distance 2.55 LD. See: 1976 UA - SSA , 1976 UA - JPL See also: https://en.wikipedia.org/wiki/2340_Hathor See also: 20 Oct 1921, 20 Oct 1976, 21 Oct 2086.
2069, Nov 5	Apollo NEA 4179 Toutatis (1989 AC, $H = 15.2$ mag, $D = 4.6 \times 2.4 \times 1.9$ km, orbital $P = 4.03$ yr, PHA) will pass Earth at a nominal miss distance of 7.72 LD. Minimum miss distance 7.72 LD. See: 4179 Toutatis - SSA , 1989 AC - JPL See also: http://en.wikipedia.org/wiki/4179_Toutatis See also: 8 Dec 1992, 30 Nov 1996, 31 Oct 2000, 29 Sep 2004, 9 Nov 2008, 12 Dec 2012.

2069, Dec 12	Apollo NEA 2013 YP139 ($H = 21.2$ mag, $D \approx 968$ m, PHA) will pass Earth at a nominal miss distance of 3.08 LD. Minimum miss distance 3.07 LD. See: 2013 YP139 - SSA , 2013 YP139 - JPL See also: https://en.wikipedia.org/wiki/2013_YP139 See also: 3 Aug 2002.
2070, Mar 15	Aten NEA 2020 FK1 ($H = 27.3$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 2.27 LD. Minimum miss distance 0.70 LD. See: 2020 FK1 – S2P , 2020 FK1 - JPL See also: 15 Mar 2020.
2070, May 26	Apollo NEA 2008 KT ($H = 28.0$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 5.88 LD. Minimum miss distance 0.96 LD. See: 2008 KT - JPL , 2008 KT - SSA
2070, Jun 6	Aten NEA 163348 (2002 NN4), ($H = 20.3$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 3.95 LD. Minimum miss distance 3.95 LD. See: 2002 NN4 - SSA , 2002 NN4- JPL See also: 5 Jun 1924, 6 Jun 1965, 7 Jun 2130.
2070, Jul 12	Apollo NEA 2015 BY3 ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of .73 LD. Minimum miss distance 0.17 LD. See: 2015 BY3 – S2P , 2015 BY3 – JPL
2070, Sep 12	Apollo NEA 2017 BL3 ($H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 4.45 LD. Minimum miss distance 4.44 LD. See: 2017 BL3 - SSA , 2017 BL3 - JPL
2070, Sep 15	Aten NEA 2020 RF3 ($H = 28.6$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 2.16 LD. Minimum miss distance 0.27 LD. See: 2020 RF3 – S2P , 2020 RF3 - JPL See also: 14 Sep 1961 , 14 Sep 2020.
2070, Sep 19	Aten NEA 2017 RX2 ($H = 26.5$ mag, $D \approx 18$ m) will pass Earth at a nominal miss distance of 2.52 LD. Minimum miss distance 0.76 LD. See: 2017 RX2 – S2P , 2017 RX2 – JPL
2070, Oct 5	Apollo NEA 2016 TH ($H = 29.4$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 1.50 LD. Minimum miss distance 0.67 LD. See: 2016 TH - SSA , 2016 TH - JPL See also: 3 Oct 2016.

2071, Feb 4	Apollo NEA 4660 Nereus (1982 DB, $H = 18.5$ mag, $D \approx 510 \times 330 \times 240$ m, PHA) will pass Earth at 5.81 LD. Minimum miss distance 5.80 LD. See: 4660 Nereus - SSA , 1982 DB - JPL Ref: - M. Brozovic, S.J. Ostro, L.A.M. Benner, et al., 2009, <i>Icarus</i>, 201, 153, "Radar observations and a physical model of asteroid 4660 Nereus, a prime space mission target." See: http://adsabs.harvard.edu/abs/2009Icar..201..153B See also: http://en.wikipedia.org/wiki/4660_Nereus See also: 29 Jan 1900, 22 Jan 2002, 11 Dec 2021, 14 Feb 2060, 23 Dec 2112, 4 Feb 2166.
2071, Apr 13	Apollo NEA 2018 GN ($H = 26.3$ mag, $D \approx 20$ m) will pass Earth at a nominal miss distance of 2.13 LD. Minimum miss distance 0.29 LD. See: 2018 GN - SSA , 2018 GN - JPL
2071, May 26	Binary Aten NEA 66391 (1999 KW4, $H = 16.9$ mag, $D \approx 1600$ m, PHA) will pass Earth at 6.82 LD. Minimum miss distance 6.82 LD. See: 66391 1999 KW4 - SSA , 1999 KW4 - JPL See also: http://en.wikipedia.org/wiki/(66391)_1999_KW4 See also: 25 May 2001, 25 May 2019.
2071, Oct 30	Apollo NEA 154276 (2002 SY50, $H = 17.6$ mag, $D \approx 1060$ m, PHA) will pass Earth at a nominal miss distance of 3.41 LD. Minimum miss distance 3.41 LD. See: 154276 2002 SY50 - SSA , 2002 SY50 - JPL
2071, Dec 25	Aten NEA 2007 YS56 ($H = 25.6$ mag, $D \approx 27$ m) will pass Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.51 LD. [2071-01] See: 2007 YS56 - SSA , 2007 YS56 - JPL
2072, Mar 25	Apollo NEA 2012 FS35, $H = 30.1$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 3.67 LD. Minimum miss distance 0.30 LD. See: 2012 FS35 - SSA , 2012 FS35 - JPL See also: 25 Mar 2012.
2072, Apr 3	Apollo NEA 2007 SQ6 ($H = 22.0$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 4.72 LD. Minimum miss distance 4.59 LD. See: 2007 SQ6 - SSA , 2007 SQ6 - JPL See also: 4 Apr 1929.
2072, Jul 26	Apollo NEA 2017 MB1 ($H = 18.6$ mag, $D \approx 700$ m, PHA) will pass

	Earth at a nominal miss distance of 1.22 LD. Minimum miss distance 1.21 LD. See: 2017 MB1 - SSA , 2017 MB1 - JPL
2072, Oct 17	Apollo NEA 453446 (2011 SM68 , $H = 19.4$ mag, $D \approx 500$ m, PHA) will pass Earth at a nominal miss distance of 1.88 LD. Minimum miss distance 1.87 LD. See: 2011 SM68 - SSA , 2011 SM68 - JPL
2072, Dec 18	Aten NEA 2017 YV8 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 9.95 LD. Minimum miss distance 0.00060 LD (= 0.036 R_{Earth} from the geocenter). See: 2017 YV8 - SSA , 2017 YV8 - JPL
2073, Apr 28	Apollo NEA 395207 (2010 HQ80 , $H = 19.9$ mag, $D \approx 660$ m, PHA) will pass Earth at a nominal miss distance of 3.23 LD. Minimum miss distance 3.23 LD. See: 2010 HQ80 - SSA , 2010 HQ80 - JPL
2073, Apr 29	Apollo NEA 164121 (2003 YT1 , $H = 16.4$ mag, $D \approx 1100$ m, PHA) will pass Earth at a nominal miss distance of 4.41 LD. Minimum miss distance 4.41 LD. See: 164121 2003 YT1 - SSA , 2003 YT1 - JPL See also: 1 May 2175 .
2073, Oct 8	Apollo NEA 2018 QT ($H = 21.1$ mag, $D \approx 220$ m, PHA) will pass Earth at a nominal miss distance of 4.05 LD. Minimum miss distance 4.05 LD. See: 2018 QT - SSA , 2018 QT - JPL See also: 10 Oct 2180 .
2073, Nov 16	Apollo NEA 2018 WG ($H = 29.4$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 8.50 LD. Minimum miss distance 0.34 LD. See: 2018 WG - SSA , 2018 WG - JPL See also: 16 Nov 2018 .
2074, Mar 24	Aten NEA 2010 FN ($H = 26.4$ mag, $D \approx 18$ m) will pass Earth at a nominal miss distance of 4.06 LD. Minimum miss distance 0.29 LD. See: 2010 FN - SSA , 2010 FN - JPL See also: 24 Oct 2001 .
2074, May 4	Apollo NEA 2006 JY26 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 3.79 LD. Minimum miss distance 0.0045 LD (= 0.27 R_{Earth} from the geocenter). See: 2006 JY26 - SSA , 2006 JY26 - JPL Ref:

	- R. Brasser, P. Wiegert, 2008, <i>Monthly Notices of the Royal Astronomical Society</i>, 386, 2931, "Asteroids on Earth-like orbits and their origin." See: http://adsabs.harvard.edu/abs/2008MNRAS.386.2931B See also: http://fromthegonzo.wordpress.com/2006/05/12/asteroid-impact-effects/ https://en.wikipedia.org/wiki/2006_JY26 See also: 10 May 2006.
2074, Jun 6	Aten NEA 2021 LC1 ($H = 26.5$ mag, $D \approx 18$ m) will pass Earth at a nominal miss distance of 8.73 LD. Minimum miss distance 0.67 LD. See: 2021 LC1 – S2P , 2021 LC1 – JPL
2074, Jun 9	Apollo NEA 2019 LW4 ($H = 26.8$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 9.00 LD. Minimum miss distance 0.17 LD. See: 2019 LW4 - SSA , 2019 LW4 - JPL See also: 7 Jun 1976, 8 Jun 2019.
2074, Jun 22	Aten NEA 2020 LV ($H = 25.3$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 4.61 LD. Minimum miss distance 0.73 LD. See: 2020 LV – S2P , 2020 LV - JPL
2074, Nov 2	Aten NEA 2020 VW ($H = 28.5$ mag, $D \approx 7$ m) passed Earth at a nominal miss distance of 1.07 LD. Minimum miss distance 0.11 LD. See: 2020 VW – S2P , 2020 VW - JPL See also: 2 Nov 2020.
2075, Nov 2	Apollo NEA 2016 VP1 ($H = 27.3$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 1.98 LD. Minimum miss distance 0.55 LD. See: 2016 VP1 - SSA , 2016 VP1 - JPL See also: 1 Nov 1929.
2075, Nov 8	Apollo NEA 308635 (2005 YU55, $H = 21.6$ mag, $D = 306$ m, $P_o = 1.22$ yr, PHA) will pass Earth at a nominal miss distance of 0.58 LD. Minimum Earth miss distance 0.50 LD. [2075-01] See: 308635 2005 YU55 - SSA , 2005 YU55 - JPL See also: http://en.wikipedia.org/wiki/2005_YU55 See also: 18 Nov 2011.
2076, Jan 13	Apollo NEA 2020 QR7 ($H = 19.2$ mag, $D \approx 500$ m, PHA) will pass Earth at a nominal miss distance of 3.25 LD. Minimum miss distance 3.22 LD. See: 2020 QR7 – S2P , 2020 QR7 - JPL

2076, Feb 12	Apollo NEA 2021 CQ5 ($H = 28.6$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 4.09 LD. Minimum miss distance 0.85 LD. See: 2021 CQ5 – S2P , 2021 CQ5 – JPL See also: 11 Feb 2021 .
2076, Apr 24	Apollo NEA 2017 HV2 ($H = 28.9$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 1.05 LD. Minimum miss distance 0.74 LD. See: 2017 HV2 – S2P , 2017 HV2 – JPL
2076, May 8	Aten NEA 2021 JQ2 ($H = 30.0$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 3.47 LD. Minimum miss distance 0.29 LD. See: 2021 JQ2 – S2P , 2021 JQ2 - JPL See also: 8 May 2021 .
2076, May 15	Apollo NEA 2019 JH7 ($H = 29.7$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 1.38 LD. Minimum miss distance 0.40 LD. See: 2019 JH7 - SSA , 2019 JH7 - JPL See also: 16 May 2019 .
2076, Jul 8	Aten NEA 2020 QN1 ($H = 23.2$ mag, $D \approx 80$ m) will pass Earth at a nominal miss distance of 2.58 LD. Minimum miss distance 0.70 LD. See: 2020 QN1 – S2P , 2020 QN1 – JPL
2076, Aug 4	Apollo NEA 385343 (2002 LV, $H = 16.8$ mag, $D \approx 1730$ m, PHA) will pass Earth at a nominal miss distance of 4.18 LD. Minimum miss distance 4.18 LD. See: 385343 2002 LV - SSA , 2002 LV - JPL
2076, Sep 27	Aten NEA 2021 SY3 ($H = 27.1$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 2.44 LD. Minimum miss distance 0.66 LD. See: 2021 SY3 – S2P , 2021 SY3 – JPL See also: 28 Sep 1902 .
2076, Dec 6	Apollo NEA 162173 Ryugu (1999 JU3, $H = 19.5$ mag, $D \approx 865$ m, PHA) will pass Earth at a nominal miss distance of 4.06 LD. Minimum miss distance 4.06 LD. See: 1999 JU3 - SSA , 1999 JU3 - JPL See also: https://en.wikipedia.org/wiki/162173_Ryugu
2076, Dec 8	Apollo NEA 2021 UF4 ($H = 26.8$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 1.64 LD. Minimum miss distance 0.99 LD. See: 2021 UF4 – S2P , 2021 UF4 – JPL

2077, Jan 1	Aten NEA 2020 YA1 ($H = 26.8$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 2.46 LD. Minimum miss distance 0.45 LD. See: 2020 YA1 – S2P , 2020 YA1 – JPL
2077, Feb 28	Apollo NEA 2020 XU6 ($H = 21.1$ mag, $D \approx 220$ m, PHA) will pass Earth at a nominal miss distance of 4.56 LD. Minimum miss distance 0.48 LD. See: 2020 XU6 – S2P , 2020 XU6 – JPL
2077, Mar 16	Apollo NEA 2015 PM ($H = 20.3$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.96 LD. Minimum miss distance 4.96 LD. See: 2015 PM - SSA , 2015 PM - JPL See also: 18 Mar 2198 .
2077, Aug 16	Apollo NEA 2008 DB ($H = 25.7$ mag, $D \approx 25$ m) will pass Earth at a nominal miss distance of 9.07 LD. Minimum miss distance 0.50 LD. See: 2008 DB – S2P , 2008 DB – JPL
2077, Oct 25	Apollo NEA 2011 WL2 ($H = 21.0$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 2.21 LD. Minimum miss distance 2.20 LD. See: 2011 WL2 - SSA , 2011 WL2 - JPL See also: https://en.wikipedia.org/wiki/2011_WL2 See also: 21 Apr 2038 .
2078, May 14	Asteroid 2017 FE1 ($H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 2.00 LD. Minimum miss distance 1.63 LD. See: 2017 FE1 - SSA , 2017 FE1 - JPL
2078, Aug 10	Apollo NEA 277475 (2005 WK4) , ($H = 20.1$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.98 LD. Minimum miss distance 4.97 LD. See: 2005 WK4- SSA , 2005 WK4- JPL See also: 9 Aug 2013 .
2078, Oct 12	Apollo NEA 496817 (1989 VB) , ($H = 20.1$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 6.75 LD. Minimum miss distance 6.75 LD. See: 1989 VB - SSA , 1989 VB - JPL See also: 13 Oct 1956, 29 Sep 2017 .
2079, Jan 17	Aten NEA 2021 CZ2 ($H = 22.5$ mag, $D \approx 110$ m) will pass Earth at a nominal miss distance of 6.25 LD. Minimum miss distance 0.79 LD.

	See: 2021 CZ2 – S2P , 2021 CZ2 - JPL
2079, Jan 29	Aten NEA 2019 BE5 ($H = 25.1$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 0.64 LD. Minimum miss distance 0.59 LD. [2079-01] See: 2019 BE5 – SSA , 2019 BE5 – JPL See also: 30 Jan 2060 .
2079, Feb 23	Aten NEA 2020 DO3 ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 4.08 LD. Minimum miss distance 0.91 LD. See: 2020 DO3 – S2P , 2020 DO3 - JPL
2079, Mar 10	Apollo NEA 2017 VR12 ($H = 20.6$ mag, $D \approx 260$ m, PHA) will pass Earth at a nominal miss distance of 4.56 LD. Minimum miss distance 4.56 LD. See: 2017 VR12 - SSA , 2017 VR12 - JPL See also: 7 Mar 2018 . See also: https://en.wikipedia.org/wiki/2017_VR12
2079, Apr 16	Amor NEA 52768 (1998 OR2) , $H = 16.1$ mag, $D \approx 2100$ m, PHA) will pass Earth at a nominal miss distance of 4.61 LD. Minimum miss distance 4.61 LD. See: 52768 1998 OR2 - SSA , 1998 OR2 - JPL See also: 16 Apr 2127 . See also: https://en.wikipedia.org/wiki/(52768)_1998_OR2
2079, Apr 26	Apollo NEA 2020 HF5 ($H = 26.8$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 9.95 LD. Minimum miss distance 0.80 LD. See: 2020 HF5 – S2P , 2020 HF5 - JPL See also: 26 Apr 1975 , 22 Apr 2020 .
2079, Jun 27	Aten NEA 2021 LD6 ($H = 27.3$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 5.97 LD. Minimum miss distance 0.67 LD. See: 2021 LD6 – S2P , 2021 LD6 – JPL See also: 1 Jul 1975 .
2079, Sep 15	Apollo NEA 2020 RD4 ($H = 29.8$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 0.49 LD. Minimum miss distance 0.27 LD. [2079-02] See: 2020 RD4 – S2P , 2020 RD4 - JPL See also: 15 Sep 2002 , 14 Sep 2020 .
2080 , Feb 15	Aten NEA 2016 DB ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 8.88 LD. Minimum miss distance 0.10 LD.

	See: 2016 DB – S2P , 2016 DB – JPL
2080, Jun 2	Apollo NEA 424482 (2008 DG5 , $H = 19.7$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 9.20 LD. Minimum miss distance 9.20 LD. See: 2008 DG5 – S2P , 2008 DG5 – JPL
2080, Jun 9	Amor NEA 2015 DP155 ($H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 9.50 LD. Minimum miss distance 9.50 LD. See: 2015 DP155 - SSA , 2015 DP155 - JPL See also: 11 Jun 2018 .
2080, Aug 31	Apollo NEA 163132 (2002 CU11 , $H = 18.7$ mag, $D \approx 460$ m, PHA) will pass Earth at a nominal miss distance of 1.65 LD. Minimum miss distance 1.65 LD. See: 2002 CU11 - SSA , 2002 CU11 - JPL See also: https://en.wikipedia.org/wiki/(163132)_2002_CU11 See also: 30 Aug 1925 .
2080, Nov 1	Apollo NEA 2020 HM7 ($H = 26.0$ mag, $D \approx 23$ m) will pass Earth at a nominal miss distance of 6.06 LD. Minimum miss distance 0.82 LD. See: 2020 HM7 – S2P , 2020 HM7 – JPL
2080, Aug 16	Apollo NEA 2017 YE ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 6.72 LD. Minimum miss distance 0.63 LD. See: 2017 YE – S2P , 2017 YE – JPL
2081 , Feb 14	Aten NEA 2020 CL1 ($H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 5.72 LD. Minimum miss distance 5.71 LD. See: 2020 CL1 – S2P , 2020 CL1 – JPL See also: 15 Feb 1940, 15 Feb 1991, 15 Feb 2036, 16 Feb 2118 .
2081, Mar 17	Aten NEA 2020 FL ($H = 24.8$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 2.59 LD. Minimum miss distance 0.98 LD. See: 2020 FL – S2P , 2020 FL - JPL
2081, Mar 22	Aten NEA 2006 GB ($H = 20.2$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 3.85 LD. Minimum miss distance 3.85 LD. See: 2006 GB - SSA , 2006 GB - JPL See also: 22 Mar 1942, 22 Mar 2037 .

2081, Sep 5	Aten NEA 2020 RY2 ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 9.98 LD. Minimum miss distance 0.65 LD. See: 2020 RY2 – S2P , 2020 RY2 - JPL
2081, Nov 14	Apollo NEA 2020 UL3 ($H = 23.3$ mag, $D \approx 80$ m) will pass Earth at a nominal miss distance of 4.80 LD. Minimum miss distance 0.41 LD. See: 2020 UL3 – S2P , 2020 UL3 – JPL
2082 , Feb 11	Apollo NEA 2013 PS13 ($H = 27.2$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 3.60 LD. Minimum miss distance 0.20 See: 2013 PS13 - SSA , 2013 PS13 - JPL See: 9 Aug 2013 .
2082, Feb 17	Apollo NEA 2020 DP14 ($H = 30.4$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 0.80 LD. Minimum miss distance 0.01 LD. [2082-01] See: 2020 DP14 – S2P , 2020 DP14 – JPL See also: 17 Feb 2020 .
2082, Aug 4	Aten NEA 2017 TU1 ($H = 26.1$ mag, $D \approx 21$ m) will pass Earth at a nominal miss distance of 2.61 LD. Minimum miss distance 0.65 LD. See: 2017 TU1 – S2P , 2017 TU1 – JPL
2082, Nov 16	Apollo NEA 2020 VH5 ($H = 29.2$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 1.54 LD. Minimum miss distance 0.68 LD. See: 2020 VH5 – S2P , 2020 VH5 – JPL See also: 13 Nov 2020 .
2082, Dec 13	Apollo NEA 2010 MU112 ($H = 20.9$ mag, $D \approx 599$ m, PHA) will pass Earth at a nominal miss distance of 2.69 LD. Minimum miss distance 2.68 LD. See: 2010 MU112 - SSA , 2010 MU112 - JPL See also: 13 Dec 1933 .
2083 , May 3	Aten NEA 467460 (2006 JF42 , $H = 19.0$ mag, $D \approx 600$ m, PHA) will pass Earth at a nominal miss distance of 3.55 LD. Minimum miss distance 3.55 LD. See: 2006 JF42 - SSA , 2006 JF42 - JPL See also: 4 May 2159 .
2083, Jun 2	Amor NEA 423321 (2005 ED318 , $H = 20.7$ mag, $D \approx 202$ m, PHA) will pass Earth at a nominal miss distance of 3.44 LD. Minimum miss distance 3.44 LD.

	See: 2005 ED318 - SSA , 2005 ED318 - JPL See also: 14 Jun 2166 .
2084 , Nov 22	Apollo NEA 2005 LW3 ($H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 1.17 LD. Minimum miss distance 1.15 LD. See: 2005 LW3 - SSA , 2005 LW3 - JPL See also: 20 Nov 1928 , 23 Nov 2022 .
2084, Dec 28	Apollo NEA 2016 GS134 ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 2.92 LD. Minimum miss distance 0.39 LD. See: 2016 GS134 – S2P , 2016 GS134 – JPL
2085 , May 1	Apollo NEA 2017 JB2 ($H = 29.3$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 3.14 LD. Minimum miss distance 0.81 LD. See: 2017 JB2 - SSA , 2017 JB2 - JPL See also: 4 May 2017 .
2085, Jun 9	Aten NEA 2021 LK6 ($H = 28.4$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 6.16 LD. Minimum miss distance 0.0074 LD (= 0.45 R_{Earth} from the geocenter) . See: 2021 LK6 – S2P , 2021 LK6 – JPL See also: 9 Jun 1972 .
2085, Sep 22	Apollo NEA 2016 CW193 ($H = 21.8$ mag, $D \approx 160$ m, PHA), will pass Earth at a nominal miss distance of 4.48 LD. Minimum miss distance 4.48 LD. See: 2016 CW193– SSA , 2016 CW193 - JPL
2085, Sep 25	Apollo NEA 2018 BP ($H = 20.7$ mag, $D \approx 260$ m, PHA), will pass Earth at a nominal miss distance of 1.68 LD. Minimum miss distance 1.66 LD. See: 2018 BP – SSA , 2018 BP - JPL
2085, Oct 13	Apollo NEA 2021 TE13 ($H = 29.3$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.23 LD. [2085-01] See: 2021 TE13 – S2P , 2021 TE13 – JPL See also: 12 Oct 2021 .
2085, Nov 13	Apollo NEA 2020 UL3 ($H = 23.3$ mag, $D \approx 80$ m) will pass Earth at a nominal miss distance of 0.46 LD. Minimum miss distance 0.43 LD. [2085-02]

	See: 2020 UL3 – S2P , 2020 UL3 – JPL
2085, Nov 20	Aten NEA 2019 OR1 ($H = 21.1$ mag, $D \approx 220$ m, PHA), will pass Earth at a nominal miss distance of 4.41 LD. Minimum miss distance 4.39 LD. See: 2019 OR1 - JPL , 2019 OR1 - SSA See also: 19 Nov 1902 , 21 Nov 2100 , 21 Nov 2178 .
2086, Feb 28	Aten NEA 2019 EM1 ($H = 22.3$ mag, $D \approx 120$ m), will pass Earth at a nominal miss distance of 8.53 LD. Minimum miss distance 0.03 LD. See: 2019 EM1 – SSA , 2019 EM1 – JPL
2086, Jul 5	Aten NEA 2018 NX ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.69 LD. [2086-01] See: 2018 NX - SSA , 2018 NX - JPL See also: 7 July 1990 , 7 July 2018 .
2086, Oct 21	Aten NEA 2340 Hathor (1976 UA , $H = 20.5$ mag, $D \approx 210$ m, PHA) will pass Earth at a nominal miss distance of 2.15 LD. Minimum miss distance 2.15 LD. See: 2340 Hathor - SSA , 1976 UA - JPL See also: https://en.wikipedia.org/wiki/2340_Hathor See also: 20 Oct 1921 , 20 Oct 1976 , 21 Oct 2069 .
2086, Oct 22	Apollo NEA 171576 (1999 VP11 , $H = 18.7$ mag, $D \approx 700$ m, PHA) will pass Earth at a nominal miss distance of 3.03 LD. Minimum miss distance 3.03 LD. See: 1999 VP11 - JPL , 1999 VP11 - SSA See also: 21 Oct 1965 , 21 Oct 1982 .
2086, Oct 31	Apollo NEA 69230 Hermes (1937 UB , $H = 17.5$ mag, $D \approx 1100$ m, PHA) will pass Earth at a nominal miss distance of 9.49 LD. Minimum miss distance 9.49 LD. See: 69230 Hermes - SSA , 1937 UB - JPL See also: http://en.wikipedia.org/wiki/69230_Hermes See also: 29 Oct 1914 , 30 Oct 1937 , 26 Apr 1942 , 1 Nov 1954 , 30 Apr 2123 .
2087, Feb 15	Aten NEA 367943 Duende (2012 DA14 , $H = 24.2$ mag, $D \approx 40 \times 20$ m) will pass Earth at a nominal miss distance of 4.49 LD. Minimum miss distance 3.77 LD. See: 367943 Duende - SSA , 2012 DA14 - JPL See also:

	http://en.wikipedia.org/wiki/2012_DA14 See also: 17 Feb 1918 , 19 Aug 2004 , 16 Feb 2012 , 15 Feb 2013 , 15 Feb 2046 .
2087, Sep 10	Apollo NEA 2021 RP2 ($H = 30.3$ mag, $D \approx 3$ m) will pass Earth at a nominal miss distance of 3.74 LD. Minimum miss distance 0.0004 LD (= 0.022 R_{Earth} from the geocenter) . See: 2021 RP2 – S2P , 2021 RP2 - JPL See also: 17 Mar 1972 , 8 Sep 2021 .
2087, Dec 1	Apollo NEA 2015 XG55 ($H = 27.7$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 7.34 LD. Minimum miss distance 0.71 LD. See: 2015 XG55 – S2P , 2015 XG55 – JPL
2088 , Feb 9	Apollo NEA 2018 CN2 ($H = 27.6$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 4.46 LD. Minimum miss distance 0.88 LD. See: 2018 CN2 - SSA , 2018 CN2 - JPL See also: 8 Feb 1935 , 9 Feb 2018 .
2088, Mar 17	Apollo NEA 2019 FE ($H = 24.2$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 1.58 LD. Minimum miss distance 0.09 LD. See: 2019 FE – SSA , 2019 FE – JPL
2088, May 15	Apollo NEA 2012 HZ33 ($H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 4.74 LD. Minimum miss distance 4.74 LD. See: 2012 HZ33 - SSA , 2012 HZ33 - JPL
2088, Oct 23	Apollo NEA 2017 UQ7 ($H = 25.2$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 8.29 LD. Minimum miss distance 0.75 LD. See: 2017 UQ7 – S2P , 2017 UQ7 – JPL
2089 , Jan 10	Apollo NEA 2016 AB166 ($H = 24.6$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 7.25 LD. Minimum miss distance 0.35 LD. See: 2016 AB166 - SSA , 2016 AB166 - JPL
2089, Mar 16	Apollo NEA 216985 (2000 QK130) , ($H = 21.3$ mag, $D \approx 200$ m, PHA) will pass Earth at a nominal miss distance of 5.17 LD. Minimum miss distance 4.48 LD. See: 2000 QK130 - SSA , 2000 QK130 - JPL See also: 12 Mar 1916 , 14 Mar 1968 , 15 Mar 2036 .
2090 , Apr 11	Aten NEA 2015 XF261 ($H = 25.3$ mag, $D \approx 30$ m) will pass Earth at

	a nominal miss distance of 0.99 LD. Minimum miss distance 0.92 LD. [2090-01] See: 2015 XF261 - SSA , 2015 XF261 - JPL
2090, Jun 14	Apollo NEA 1566 Icarus (1949 MA, $H = 16.3$ mag, $D \approx 1300$ m, PHA) will pass Earth at a nominal miss distance of ~ 17 LD. Minimal miss distance ~ 17 LD. See: 1566 Icarus - SSA , 1949 MA - JPL See also: http://www.jpl.nasa.gov/news/news.php?feature=4625 http://en.wikipedia.org/wiki/1566_Icarus See also: 14 Jun 1968, 16 Jun 2015.
2090, Nov 5	Apollo NEA 2017 VE ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 7.66 LD. Minimum miss distance 0.74 LD. See: 2017 VE - SSA , 2017 VE - JPL See also: 4 Nov 2017.
2091 , Oct 14	Apollo/Aten (?) NEA 2020 TK7 ($H = 29.6$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 9.97 LD. Minimum miss distance 0.70 LD. See: 2020 TK7 – S2P , 2020 TK7 - JPL See also: 14 Oct 2020.
2091, Nov 2	Apollo NEA 2019 VA1 ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 5.73 LD. Minimum miss distance 0.73 LD. See: 2019 VA1 – SSA , 2019 VA1 – JPL
2091, Nov 11	Apollo NEA 2019 JY2 ($H = 29.6$ mag, $D \approx 4$ m) will pass Earth at a nominal miss distance of 4.62 LD. Minimum miss distance 0.44 LD. See: 2019 JY2 – S2P , 2019 JY2 – JPL
2092 , Apr 27	Aten NEA 2014 JU15 ($H = 24.9$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 5.42 LD. Minimum miss distance 0.18 LD. See: 2014 JU15 - SSA, 2014 JU15 - JPL See also: 28 Apr 2110.
2092, May 12	Apollo NEA 2021 JY5 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 3.92 LD. Minimum miss distance 0.08 LD. See: 2021 JY5 – S2P , 2021 JY5 – JPL
2092, Oct 6	Apollo NEA 2015 TQ21 ($H = 27.6$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 2.40 LD. Minimum miss distance 0.53 LD. See: 2015 TQ21 - SSA , 2015 TQ21 - JPL

	See also: 7 Oct. 2015 .
2092, Oct 26	Apollo NEA 2019 UB6 ($H = 28.4$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 3.08 LD. Minimum miss distance 0.97 LD. See: 2019 UB6 – SSA , 2019 UB6 – JPL
2092, Oct 27	Aten NEA 2004 TD10 ($H = 22.2$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 3.05 LD. Minimum miss distance 3.05 LD. See: 2004 TD10 – SSA , 2004 TD10 – JPL
2093 , Apr 19	Apollo NEA 2014 SM143 ($H = 20.4$ mag, $D \approx 290$ m, PHA) will pass Earth at a nominal miss distance of 3.87 LD. Minimum miss distance 3.87 LD. See: 2014 SM143 - SSA , 2014 SM143 - JPL See also: 20 Apr 1934 , 23 Oct 2197 .
2093, Sep 27	Apollo NEA 2018 TR ($H = 25.5$ mag, $D \approx 28$ m) will pass Earth at a nominal miss distance of 1.59 LD. Minimum miss distance 0.54 LD. See: 2018 TR - SSA , 2018 TR - JPL
2093, Oct 5	Apollo NEA 350751 (2002 AW) , ($H = 21.1$ mag, $D \approx 210$ m, PHA) will pass Earth at a nominal miss distance of 4.20 LD. Minimum miss distance 4.12 LD. See: 2002 AW - SSA , 2002 AW - JPL
2093, Nov 30	Aten NEA 153201 (2000 WO107) , ($H = 19.1$ mag, $D \approx 510$ m, PHA) will pass Earth at 3.23 LD. Minimum miss distance 3.23 LD. See: 2000 WO107 - JPL , 2000 WO107 - SSA See also: https://en.wikipedia.org/wiki/(153201)_2000_WO107 See also: 29 Nov 1953 , 1 Dec 2140 .
2093, Dec 14	Apollo NEA 3200 Phaethon (1983 TB) , ($H = 14.4$ mag, $D \approx 5.1 \pm 0.2$ km, PHA) will pass Earth at a nominal miss distance of 7.71 LD. Minimum miss distance 7.71 LD. See: 3200 Phaethon - SSA , 1983 TB - JPL See also: http://en.wikipedia.org/wiki/3200_Phaethon See also: 16 Dec 2017 .
2094 , Mar 13	Apollo NEA 2017 FD157 ($H = 22.1$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 5.18 LD. Minimum miss distance 0.46 LD. See: 2017 FD157 - JPL , 2017 FD157 - SSA
2094, May 25	Apollo NEA 2013 YD48 ($H = 22.8$ mag, $D \approx 100$ m) will pass Earth

	at a nominal miss distance of 4.47 LD. Minimum miss distance 0.12 LD. See: 2013 YD48 - SSA , 2013 YD48 - JPL
2094, Aug 7	Apollo NEA 2020 FT3 ($H = 23.2$ mag, $D \approx 80$ m) will pass Earth at a nominal miss distance of 2.41 LD. Minimum miss distance 0.37 LD. See: 2020 FT3 – S2P , 2020 FT3 – JPL
2094, Nov 5	Apollo NEA 2015 JJ ($H = 22.3$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 3.48 LD. Minimum miss distance 1.94 LD. See: 2015 JJ - SSA , 2015 JJ - JPL See also: 4 Nov 1989, 5 Nov 2050, 6 Nov 2110.
2095 , Mar 25	Aten NEA 2016 FZ13 ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 8.78 LD. Minimum miss distance 0.73 LD. See: 2016 FZ13 - SSA , 2016 FZ13 - JPL See also: 23 March 2016.
2095, Apr 9	Apollo NEA 297300 (1998 SC15, $H = 19.3$ mag, $D \approx 500$ m, PHA) will pass Earth at a nominal miss distance of 3.30 LD. Minimum miss distance 3.30 LD. See: 1998 SC15 - JPL , 1998 SC15 - SSA
2095, May 13	Apollo NEA 2019 JJ3 ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 5.85 LD. Minimum miss distance 0.30 LD. See: 2019 JJ3 – SSA , 2019 JJ3 – JPL See also: 7 May 1970.
2095, May 24	Apollo NEA 2020 KU ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 0.40 LD. Minimum miss distance 0.05 LD. [2095-01] See: 2020 KU – S2P , 2020 KU – JPL
2095, Sep 6	Apollo NEA 2010 RF12 ($H = 28.1$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 0.102 LD (= 6.14 R_{Earth} from the geocenter). Minimum miss distance 0.0037 LD (= 0.22 R_{Earth} from the geocenter). [2095-02] See: 2010 RF12 - SSA , 2010 RF12 - JPL See also: http://en.wikipedia.org/wiki/2010_RF12 See also: 10 Sep 1915, 8 Sep 2010.
2095, Oct 27	Apollo NEA 35396 (1997 XF11, $H = 17.3$mag, $D = 1200$ m, PHA) will pass Earth at a nominal miss distance of 5.09 LD. Minimum miss distance 5.05 LD. See: 35396 1997 XF11 - SSA , 1997 XF11 - JPL

	See also: http://www.minorplanetcenter.net/iau/pressinfo/1997XF11Globe.html http://en.wikipedia.org/wiki/(35396)_1997_XF11 See also: 11 Mar 1998, 26 Oct 2028.
2095, Dec 9	Apollo NEA 2015 XX128 ($H = 26.1$ mag, $D \approx 22$ m) will pass Earth at a nominal miss distance of 0.92 LD. Minimum miss distance 0.49 LD. [2095-03] See: 2015 XX128- SSA , 2015 XX128 - JPL
2095, Dec 11	Apollo NEA 2013 XY8 ($H = 25.0$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 0.89 LD. Minimum miss distance 0.84 LD. [2095-04] See: 2013 XY8 - SSA , 2013 XY8 - JPL See also: https://en.wikipedia.org/wiki/2013_XY8
2096, Feb 29	Apollo NEA 269690 (1996 RG3, $H = 18.5$ mag, $D \approx 879$ m, PHA) will pass Earth at a nominal miss distance of 2.43 LD. Minimum miss distance 2.43 LD. See: 1996 RG3 - JPL , 1996 RG3 - SSA
2096, May 7	Apollo NEA 438908 (2009 XO, $H = 20.1$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.02 LD. Minimum miss distance 4.02 LD. See: 2009 XO - JPL , 2009 XO - SSA See also: 7 May 2020.
2096, Oct 12	Apollo NEA 475016 (2005 UO, $H = 21.9$ mag, $D \approx 164$ m) will pass Earth at a nominal miss distance of 1.26 LD. Minimum miss distance 1.26 LD. See: 2005 UO - SSA , 2005 UO - JPL
2096, Dec 27	Aten NEA 2010 XC15 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 1.68 LD. Minimum miss distance 1.66 LD. See: 2010 XC15 - JPL , 2010 XC15 - SSA See also: https://en.wikipedia.org/wiki/2010_XC15 See also: 26 Dec 1907, 27 Dec 1914, 27 Dec 1976, 27 Dec 2022, 28 Dec 2059, 26 Dec 2064.
2097, Dec 14	Apollo NEA 2016 WJ1 ($H = 21.4$ mag, $D \approx 180$ m, PHA) will pass Earth at a nominal miss distance of 1.23 LD. Minimum miss distance 0.25 LD.

	See: 2016 WJ1 - SSA , 2016 WJ1 - JPL See also: 14 Dec 1920 , 14 Dec 2061 .
2097, Dec 23	Apollo NEA 2020 YN2 ($H = 28.4$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 1.82 LD. Minimum miss distance 0.90 LD. See: 2020 YN2 – S2P , 2020 YN2 – JPL See also: 22 Dec 2020 .
2098 , Jan 12	Apollo NEA 2021 AX1 ($H = 27.6$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.36 LD. [2098-01] See: 2021 AX1 – S2P , 2021 AX1 – JPL
2098, Mar 23	Apollo NEA 2021 FT1 ($H = 24.4$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 0.23 LD. Minimum miss distance 0.15 LD. [2098-02] See: 2021 FT1 – S2P , 2021 FT1 - JPL
2098, Aug 6	Apollo NEA 2021 PK4 ($H = 28.1$ mag, $D \approx 8$ m) passed Earth at a nominal miss distance of 6.37 LD. Minimum miss distance 0.46 LD. See: 2021 PK4 – S2P , 2021 PK4 – JPL See also: 6 Aug 2021 .
2099 , Jan 28	Apollo NEA 2020 BK13 ($H = 28.5$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 1.05 LD. Minimum miss distance 0.76 LD. See: 2020 BK13 – S2P , 2020 BK13 – JPL
2099, Apr 3	Apollo NEA 2018 GZ ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 3.29 LD. Minimum miss distance 0.11 LD. See: 2018 GZ - SSA , 2018 GZ - JPL
2099, Aug 5	Aten NEA 2018 MD7 ($H = 22.6$ mag, $D \approx 110$ m) will pass Earth at a nominal miss distance of 5.66 LD. Minimum miss distance 0.78 LD. See: 2018 MD7 – SSA , 2018 MD7 – JPL
2099, Dec 18	Aten NEA 33342 (1998 WT24) , $H = 18.3$ mag, $D \approx 415$ m, PHA) will pass Earth at a nominal miss distance of 4.92 LD. Minimum miss distance 4.92 LD. See: 33342 1998 WT24 - SSA , 1998 WT24 - JPL Ref: - A.M. MacRobert, <i>Sky & Telescope</i> , 25 June 2004, "A close visitor tumbles by." See: http://www.skyandtelescope.com/news/3304726.html

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2100, Apr 26	Apollo NEA 2011 JA ($H = 21.4$ mag, $D \approx 190$ m, PHA) will pass Earth at a nominal miss distance of 0.54 LD. Minimum miss distance 0.54 LD. [2100-01] See: 2011 JA - SSA , 2011 JA - JPL
2100, Apr 27	Apollo NEA 363116 (2001 GQ2, $H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 1.32 LD. Minimum miss distance 1.32 LD. See: 2001 GQ2 - JPL , 2001 GQ2 - SSA
2100, Jun 30	Apollo NEA 2020 ME1 ($H = 26.3$ mag, $D \approx 20$ m) will pass Earth at a nominal miss distance of 3.41 LD. Minimum miss distance 0.26 LD. See: 2020 ME1 - S2P , 2020 ME1 - JPL
2100, Aug 10	Apollo NEA 2021 AY5 ($H = 25.0$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 4.23 LD. Minimum miss distance 0.60 LD. See: 2021 AY5 - S2P , 2021 AY5 - JPL
2100, Nov 21	Aten NEA 2019 OR1 ($H = 21.0$ mag, $D \approx 220$ m, PHA) will pass Earth at a nominal miss distance of 4.95 LD. Minimum miss distance 4.91 LD. See: 2019 OR1 - S2P , 2019 OR1 - JPL See als: 19 Nov 1902, 20 Nov 2085, 21 Nov 2178.
2101, Jan 2	Apollo NEA 456938 (2007 YV56, $H = 21.0$ mag, $D \approx 220$ m, PHA) will pass Earth at a nominal miss distance of 0.62 LD. Minimum miss distance 0.62 LD. [2101-01] See: 2007 YV56 - SSA , 2007 YV56 - JPL See also: https://en.wikipedia.org/wiki/2007_YV56
2101, Apr 24	Apollo NEA 2008 GD110 ($H = 24.5$ mag, $D \approx 40$ m) will pass Earth

	at a nominal miss distance of 6.99 LD. Minimum miss distance 0.29 LD. See: 2008 GD110 – S2P , 2008 GD110 – JPL
2101, Aug 6	Apollo NEA 399457 (2002 PD43 , $H = 19.2$ mag, $D \approx 500$ m, PHA) will pass Earth at a nominal miss distance of 2.43 LD. Minimum miss distance 2.41 LD. See: 2002 PD43 - JPL , 2002 PD43 - SSA
2101, Oct 25	Apollo NEA 2020 FM6 ($H = 21.9$ mag, $D \approx 150$ m, PHA) will pass Earth at a nominal miss distance of 7.91 LD. Minimum miss distance 3.97 LD. See: 2020 FM6 – S2P , 2020 FM6 - JPL See also: 24 Oct 1964 .
2102 , Jan 7	Apollo NEA 471240 (2011 BT15 , $H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 3.43 LD. Minimum miss distance 3.33 LD. See: 2011 BT15 - JPL , 2011 BT15 - SSA See also: https://en.wikipedia.org/wiki/(471240)_2011_BT15 See also: 3 Jan 1983 .
2102, Mar 13	Aten NEA 2021 ER4 ($H = 27.2$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 2.03 LD. Minimum miss distance 0.34 LD. See: 2021 ER4 – S2P , 2021 ER4 - JPL
2102, May 15	Apollo NEA 2010 WC9 ($H = 23.8$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 14.82 LD. Minimum miss distance 0.89 LD. See: 2010 WC9 - SSA , 2010 WC9 - JPL See also: https://en.wikipedia.org/wiki/2010_WC9 See also: 15 May 2018 , 17 May 2156
2102, Aug 31	Apollo NEA 2009 DM45 ($H = 21.2$ mag, $D \approx 200$ m, PHA) will pass Earth at a nominal miss distance of 4.72 LD. Minimum miss distance 4.70 LD. See: 2019 DM45 – S2P , 2019 DM45 – JPL
2102, Sep 11	Aten NEA Apophis (2004 MN4 , $H = 18.9$ mag, $D \approx 375$ m, PHA) will pass Earth at a nominal miss distance of 9.12 LD. Minimum miss distance 8.75 LD. See: 2004 MN4 – S2P , 2004 MN4 – JPL See also: 14 Apr 1998 , 13 Apr 2029 , 12 Apr 2116 .
2102, Sep 12	Apollo NEA 2020 DR2 ($H = 18.8$ mag, $D \approx 600$ m, PHA) will pass

	Earth at a nominal miss distance of 11.44 LD. Minimum miss distance 2.14 LD. See: 2020 DR2 – S2P , 2020 DR2 - JPL
2103 , Feb 22	Aten NEA 1995 CR, $H = 21.9$ mag, $D \approx 100$ m, PHA) will pass Earth at a nominal miss distance of 4.29 LD. Minimum miss distance 4.28 LD. See: 1995 CR - JPL , 1995 CR - SSA
2103, Mar 23	Apollo NEA 231937 (2001 FO32), $H = 17.6$ mag, $D \approx 1100$ m, PHA) will pass Earth at a nominal miss distance of 8.22 LD. Minimum miss distance 8.19 LD. See: 2001 FO32 – S2P , 2001 FO32 – JPL But, NEOWISE: $D \approx 440 - 680$ m. See: http://neo.ssa.esa.int/newsletters [March 2021] https://www.jpl.nasa.gov/news/asteroid-2001-fo32-will-safely-pass-by-earth-march-21 See also: 21 Mar 2021, 22 Mar 2052.
2105 , Feb 26	Apollo NEA 2017 DR34 ($H = 29.2$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 4.66 LD. Minimum miss distance 0.94 LD. See: 2017 DR34 - SSA , 2017 DR34 - JPL See also: 25 Feb 2017.
2105, Aug 24	Apollo NEA 2020 QR5 ($H = 27.3$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 2.98 LD. Minimum miss distance 0.11 LD. See: 2020 QR5 – S2P , 2020 QR5 – JPL See also: 20 Aug 1959, 23 Aug 2020.
2106 , Apr 21	Apollo NEA 162416 (2000 EH26), $H = 21.7$ mag, $D \approx 141$ m, PHA) will pass Earth at a nominal miss distance of 3.61 LD. Minimum miss distance 3.59 LD. See: 2000 EH26 - JPL , 2000 EH26 - SSA See also: 22 Jun 2167.
2107 , May 7	Aten NEA 2015 KE ($H = 26.3$ mag, $D \approx 20$ m) will pass Earth at a nominal miss distance of 4.76 LD. Minimum miss distance 0.12 LD. See: 2015 KE - SSA , 2015 KE - JPL See also: 18 Sep 1955.
2108 , Jul 2	Asteroid 436724 (2011 UW158), $H = 20.0$ mag, $D \approx 600 \times 300$ m, PHA) will pass Earth at a nominal miss distance of 4.26 LD. Minimum miss distance 4.26 LD. See: 2011 UW158 - JPL , 2011 UW158 - SSA

	See also: https://en.wikipedia.org/wiki/(436724)_2011_UW158 See also: 1 Jul 1978 .
2108, Oct 1	Apollo NEA 2016 TD ($H = 28.4$ mag, $D \approx 7$ m) will pass Earth at a nominal miss distance of 1.44 LD. Minimum miss distance 0.94 LD. See: 2016 TD - SSA , 2016 TD - JPL See also: 30 Sep 2016 .
2110 , Jun 4	Aten NEA 437844 (1999 MN) , $H = 20.8$ mag, $D \approx 240$ m, PHA) will pass Earth at a nominal miss distance of 2.64 LD. Minimum miss distance 2.64 LD. See: 1999 MN - JPL , 1999 MN - SSA See also: 2 Jun 1938 , 2 Jun 1943 , 4 Jun 2137 , 3 Jun 2148 .
2110, Dec 16	Apollo NEA 2019 YS ($H = 31.5$ mag, $D \approx 1.8$ m) will pass Earth at a nominal miss distance of 7.35 LD. Minimum miss distance 0.21 LD. See: 2019 YS - SSA , 2019 YS - JPL
2111 , Aug 3	Apollo NEA 2019 YB4 ($H = 26.4$ mag, $D \approx 19$ m) will pass Earth at a nominal miss distance of 5.68 LD. Minimum miss distance 0.86 LD. See: 2019 YB4 - S2P , 2019 YB4 - JPL See also: 2 Aug 2112 .
2111, Aug 19	Apollo NEA 2020 QF2 ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 4.89 LD. Minimum miss distance 0.70 LD. See: 2020 QF2 - S2P , 2020 QF2 - JPL See also: 18 Aug 2020 .
2111, Aug 26	Aten NEA 2018 QS1 ($H = 27.5$ mag, $D \approx 11$ m) will pass Earth at a nominal miss distance of 8.76 LD. Minimum miss distance 0.57 LD. See: 2018 QS1 - SSA , 2018 QS1 - JPL
2112 , Jun 7	Apollo NEA 2016 LT1 ($H = 29.3$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 5.02 LD. Minimum miss distance 0.75 LD. See: 2016 LT1- S2P , 2016 LT1- JPL
2112, Aug 2	Apollo NEA 2019 YB4 ($H = 26.4$ mag, $D \approx 19$ m) will pass Earth at a nominal miss distance of 6.14 LD. Minimum miss distance 0.85 LD. See: 2019 YB4 - S2P , 2019 YB4 - JPL See also: 3 Aug 2111 .
2112, Nov 8	Apollo NEA 2017 UJ43 ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 0.45 LD. Minimum miss distance 0.18 LD. [2112-01]

	See: 2017 UJ43 - SSA , 2017 UJ43 - JPL
2112, Dec 23	Apollo NEA 4660 Nereus (1982 DB, $H = 18.8$ mag, $D \approx 510 \times 320 \times 240$ m, PHA) will pass Earth at a nominal distance of 6.96 LD. Minimum distance 6.89 LD See: 4660 Nereus - SSA , 1982 DB - JPL Ref: - M. Brozovic, S.J. Ostro, L.A.M. Benner, et al., 2009, <i>Icarus</i>, 201, 153, "Radar observations and a physical model of asteroid 4660 Nereus, a prime space mission target." See: http://adsabs.harvard.edu/abs/2009Icar..201..153B - K. Kitazato, S. Abe, M. Ishiguro, et al., October 2012, American Astronomical Society, DPS meeting #44, #210.20, "Measuring the YORP effect of asteroid 4660 Nereus." See: http://adsabs.harvard.edu/abs/2012DPS....4421020K See also: http://en.wikipedia.org/wiki/4660_Nereus See also: 22 Jan 2002, 11 Dec 2021, 14 Feb 2060, 4 Feb 2071, 4 Feb 2166.
2114, Mar 2	Aten NEA 2019 EM1 ($H = 22.5$ mag, $D \approx 110$ m) will pass Earth at a nominal miss distance of 0.95 LD. Minimum miss distance 0.89 LD. [2114-01] See: 2019 EM1 - JPL , 2019 EM1 - SSA See also: 28 Feb 2086.
2115, Jul 29	Aten NEA 2018 PZ21 ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 8.54 LD. Minimum miss distance 0.34 LD. See: 2018 PZ21 - SSA , 2018 PZ21 - JPL See also: 30 Jul 2119.
2116, Apr 4	Aten NEA 2014 GC49 ($H = 28.9$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 6.90 LD. Minimum miss distance 0.63 LD. See: 2014 GC49 - SSA , 2014 GC49 - JPL
2116, Apr 12	Aten NEA Apophis (2004 MN4, $H = 18.9$ mag, $D \approx 375$ m, PHA) will pass Earth at a nominal miss distance of 7.57 LD. Minimum miss distance 0.39 LD. See: 2004 MN4 – S2P , 2004 MN4 – JPL See also: 14 Apr 1998, 13 Apr 2029, 11 Sep 2102, 12 Apr 2116.
2116, Nov 26	Apollo NEA 152685 (1998 MZ, $H = 19.4$ mag, $D \approx 590$ m, PHA) will pass Earth at 1.07 LD. Minimum miss distance 1.07 LD. See: 1998 MZ - JPL , 1998 MZ - SSA
2116, Dec 17	Aten NEA 2011 CL50 ($H = 27.3$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 4.82 LD. Minimum miss distance 0.78 LD.

	See: 2011 CL50 – S2P , 2011 CL50 – JPL
2117 , Nov 1	Aten NEA 2000 UK11 ($H = 25.5$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 2.29 LD. Minimum miss distance 0.17 LD. See: 2000 UK11 - SSA , 2000 UK11 - JPL
2118 , Feb 16	Aten NEA 2020 CL1 ($H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 5.40 LD. Minimum miss distance 5.36 LD. See: 2020 CL1 – S2P , 2020 CL1 – JPL See also: 15 Feb 1940, 15 Feb 1991, 15 Feb 2036, 14 Feb 2018.
2118, Jun 6	Apollo NEA 2007 VK184 ($H = 22.2$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 5.46 LD. Minimum miss distance 0.35 LD. See: 2007 VK184 - SSA , 2007 VK184 - JPL See also: http://neo.jpl.nasa.gov/news/news183.html https://en.wikipedia.org/wiki/2007_VK184 See also: 6 Nov 2007, 2 Jun 2048.
2119 , May 20	Aten NEA 2004 KG1 ($H = 24.2$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 1.63 LD. Minimum miss distance 0.27 LD. See: 2004 KG1 - SSA , 2004 KG1 - JPL
2119, 30 Jul	Aten NEA 2018 PZ21 ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 1.77 LD. Minimum miss distance 0.12 LD. See: 2018 PZ21 - SSA , 2018 PZ21 - JPL See also: 29 Jul 2115.
2119, Oct 23	Apollo NEA 2017 TA6 ($H = 26.8$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 7.30 LD. Minimum miss distance 0.92 LD. See: 2017 TA6 - SSA , 2017 TA6 - JPL
2120 , Jan 23	Apollo NEA 2018 BL11 ($H = 28.3$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 1.65 LD. Minimum miss distance 0.03 LD. See: 2018 BL 11 – SSA , 2018 BL11 – JPL
2120, Apr 25	Aten NEA 2011 DV ($H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 1.86 LD. Minimum miss distance 0.31 LD. See: 2011 DV - SSA , 2011 DV - JPL See also: 25 Apr 1928.
2121 , Jun 5	Aten NEA 2020 LO ($H = 26.8$ mag, $D \approx 15$ m) will pass Earth at a

	nominal miss distance of 0.52 LD. Minimum miss distance 0.51 LD. [2121-01] See: 2020 LO – S2P , 2020 LO – JPL
2121, Sep 3	Apollo NEA 2011 ES4 ($H = 25.9$ mag, $D \approx 24$ m) will pass Earth at a nominal miss distance of 1.05 LD. Minimum miss distance 0.29 LD. See: 2011 ES4 – S2P , 2011 ES4 – JPL
2122 , Feb 14	Aten NEA 2014 WQ202 ($H = 23.9$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 2.65 LD. Minimum miss distance 0.98 LD. See: 2014 WQ202 - SSA , 2014 WQ202 - JPL
2122, Sep 3	Aten NEA 2004 KG1 ($H = 24.0$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 3.26 LD. Minimum miss distance 0.23 LD. See: 2004 KG1 – S2P , 2004 KG1 – JPL
2122, Nov 30	Apollo NEA 416801 (2005 GC120 , $H = 19.6$ mag, $D \approx 906$ m, PHA) will pass Earth at a nominal miss distance of 2.08 LD. Minimum miss distance 2.07 LD. See: 2005 GC120 - JPL , 2005 GC120 - SSA
2122, Dec 16	Aten NEA 487577 (2014 YQ15 , $H = 20.9$ mag, $D \approx 240$ m, PHA) will pass Earth at a nominal miss distance of 3.84 LD. Minimum miss distance 2.61 LD. See: 2014 YQ15 - JPL , 2014 YQ15 - SSA See also: 15 Dec 1959 , 15 Dec 2066 .
2123 , Apr 7	Apollo NEA 99942 Apophis (2004 MN4 , $H = 19.7$ mag, $D = 310 \pm 30$ m, orbital $P = 0.89$ yr, PHA) will pass Earth at a nominal miss distance of 43.42 LD. Minimum miss distance 0.39 LD. See: 2004 MN4 – SSA , 2004 MN4 - JPL See also: http://www.esa.int/Our_Activities/Space_Science/Herschel_intercepts_asteroid_Apophis http://www.jpl.nasa.gov/asteroidwatch/newsfeatures.cfm?release=2013-017 http://neo.jpl.nasa.gov/apophis/ https://cneos.jpl.nasa.gov/doc/apophis/ http://news.bbc.co.uk/2/hi/science/nature/8296796.stm http://www.scientificamerican.com/blog/post.cfm?id=planetary-bombardments-past-and-fut-2009-10-08 http://en.rian.ru/science/20110126/162318648.html http://www.space.com/10752-apophis-asteroid-hit-earth.html http://www.space.com/19221-asteroid-apophis-earth-safe-2036.html https://phys.org/news/2017-06-impact-threat-asteroid-apophis.html https://phys.org/news/2017-08-asteroid-apophis-chance-earth-expert.html http://en.wikipedia.org/wiki/99942_Apophis See also: 13 Apr 1907 , 14 Apr 1949 , 14 Apr 1998 , 13 Apr 2029 , 30

	Mar 2036.
2123, Apr 30	Apollo NEA 69230 Hermes (1937 UB, <i>H</i> = 17.5 mag, <i>D</i> ≈ 1100 m, <i>PHA</i>) will pass Earth at a nominal miss distance of 6.25 LD. Minimum miss distance 4.96 LD. See: 69230 Hermes - SSA , 1937 UB - JPL See also: http://en.wikipedia.org/wiki/69230_Hermes See also: 29 Oct 1914, 30 Oct 1937, 26 Apr 1942, 1 Nov 1954, 31 Oct 2086.
2123, Jul 19	Apollo NEA 2016 BA15 (<i>H</i> = 26.8 mag, <i>D</i> ≈ 16 m) will pass Earth at a nominal miss distance of 9.89 LD. Minimum miss distance 0.24 LD. See: 2016 BA15 – S2P , 2016 BA 15 – JPL
2123, Nov 4	Apollo NEA 65803 Didymos (1996 GT, <i>H</i> = 18.1 mag, <i>D</i> ≈ 780 + 160 m, <i>PHA</i>) will pass Earth at 15.23 LD (= 0.04 AU). Minimum miss distance 15.23 LD. Flyby target for AIDA mission. See: 65803 Didymos - SSA , 1996 GT - JPL See also: https://en.wikipedia.org/wiki/65803_Didymos See also: 12 Nov 2003, 29 May 2012, 4 Oct 2022.
2124, Jan 8	Apollo NEA 2018 BM3 (<i>H</i> = 21.9 mag, <i>D</i> ≈ 150 m, <i>PHA</i>) will pass Earth at a nominal miss distance of 8.65 LD. Minimum miss distance 0.69 LD. See: 2018 BM3 – S2P , 2018 BM3 – JPL
2124, Apr 20	Apollo NEA 2021 HE1 (<i>H</i> = 28.9 mag, <i>D</i> ≈ 6 m) will pass Earth at a nominal miss distance of 7.81 LD. Minimum miss distance 0.95 LD. See: 2021 HE1 – S2P , 2021 HE1 - JPL See also: 17 Apr 2021.
2124, Oct 1	Apollo NEA 2017 SX17 (<i>H</i> = 28.3 mag, <i>D</i> ≈ 8 m) will pass Earth at a nominal miss distance of 9.13 LD. Minimum miss distance 0.15 LD. See: 2017 SX17 - SSA , 2017 SX17 - JPL See also: 2 Oct 2017.
2125, Feb 26	Apollo NEA 2019 DS1 (<i>H</i> = 25.6 mag, <i>D</i> ≈ 26 m) will pass Earth at a nominal miss distance of 9.80 LD. Minimum miss distance 0.51 LD. See: 2019 DS1 - SSA , 2019 DS1 - JPL See also: 26 Feb 1970
2125, Aug 19	Apollo NEA 2017 RV (<i>H</i> = 21.9 mag, <i>D</i> ≈ 150 m, <i>PHA</i>) will pass Earth at a nominal miss distance of 2.56 LD. Minimum miss distance 2.53 LD.

	See: 2017 RV - JPL , 2017 RV - SSA See also: 17 Aug 1979, 19 Aug 2175.
2125, Nov 8	Apollo NEA 525484 (2005 GL , $H = 21.0$ mag, $D \approx 220$ m, PHA) will pass Earth at a nominal miss distance of 4.31 LD. Minimum miss distance 4.27 LD. See: 2005 GL - JPL , 2005 GL - SSA See also: 7 Nov 2058.
2127 , Mar 29	Apollo NEA 2016 FU6 ($H = 28.8$ mag, $D \approx 6$ m) will pass Earth at a nominal miss distance of 5.77 LD. Minimum miss distance 0.67 LD. See: 2016 FU6 - SSA , 2016 FU6 - JPL
2127, Apr 16	Amor NEA 52768 (1998 OR2 , $H = 16.1$ mag, $D \approx 2100$ m, PHA) will pass Earth at a nominal miss distance of 6.53 LD. Minimum miss distance 6.53 LD. See: 52768 1998 OR2 - SSA , 1998 OR2 - JPL See also: https://en.wikipedia.org/wiki/(52768)_1998_OR2 See also: 16 April 2079.
2127, Oct 10	Apollo NEA 2016 QE45 ($H = 21.9$ mag, $D \approx 150$ m, PHA) will pass Earth at a nominal miss distance of 2.25 LD. Minimum miss distance 2.24 LD. See: 2016 QE45– S2P , 2016 QE45 – JPL
2128 , Mar 6	Apollo NEA 2014 EG45 ($H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 4.12 LD. Minimum miss distance 1.55 LD. See: 2014 EG45 - JPL , 2014 EG45 - SSA See also: 4 Mar 2014, 4 Mar 2065.
2128, Mar 11	Apollo NEA 2008 ED8 ($H = 24.0$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 1.15 LD. Minimum miss distance 0.52 LD. See: 2008 ED8 – S2P , 2008 ED8 - JPL
2128, Mar 16	Aten NEA 2021 FA ($H = 25.1$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 5.38 LD. Minimum miss distance 0.78 LD. See: 2021 FA – S2P , 2021 FA – JPL
2128, Nov 27	Apollo NEA 2000 KA ($H = 21.9$ mag, $D \approx 150$ m, PHA) will pass Earth at a nominal miss distance of 5.73 LD. Minimum miss distance 5.73 LD. See: 2000 KA - SSA , 2000 KA - JPL See also: 12 May 2020, 15 May 2158.

2129, May 30	Apollo NEA 2019 KG2 ($H = 25.4$ mag, $D \approx 29$ m) will pass Earth at a nominal miss distance of 6.16 LD. Minimum miss distance 0.07 LD. See: 2019 KG2 – SSA , 2019 KG2 – JPL
2129, Jun 20	Apollo NEA 443104 (2013 XK22) , $H = 24.3$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 6.13 LD. Minimum miss distance 0.44 LD. See: 443104 2013 XK22 - SSA , 2013 XK22 - JPL
2129, Sep 28	Apollo NEA 2019 SW5 ($H = 25.1$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 6.05 LD. Minimum miss distance 0.33 LD. See: 2019 SW5 – S2P , 2019 SW5 – JPL
2129, Oct 12	Aten NEA 2017 UA45 ($H = 26.0$ mag, $D \approx 23$ m) will pass Earth at a nominal miss distance of 4.77 LD. Minimum miss distance 0.68 LD. See: 2017 UA45 – S2P , 2017 UA45 – JPL
2129, Oct 19	Aten NEA 2007 UW1 ($H = 22.9$ mag, $D \approx 90$ m) will pass Earth at a nominal miss distance of 0.22 LD. Minimum miss distance 0.15 LD. [2129-01] See: 2007 UW1 - SSA , 2007 UW1 - JPL See also: https://en.wikipedia.org/wiki/2007_UW1
2129, Oct 30	Aten NEA 2008 VR4 ($H = 23.0$ mag, $D \approx 90$ m) will pass Earth at a nominal miss distance of 9.44 LD. Minimum miss distance 0.94 LD. See: 2008 VR4 – S2P , 2008 VR4 – JPL
2130, Jan 27	Apollo NEA 85182 (1991 AQ) , $H = 17.2$ mag, $D \approx 1098$ m, PHA) will pass Earth at a nominal miss distance of 4.14 LD. Minimum miss distance 4.14 LD. See: 85182 1991 AQ - SSA , 1991 AQ - JPL See also: https://en.wikipedia.org/wiki/(85182)_1991_AQ
2130, Jun 7	Aten NEA 163348 (2002 NN4) , $H = 20.3$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 2.75 LD. Minimum miss distance 2.75 LD. See: 2002 NN4 - JPL , 2002 NN4 - SSA See also: 5 Jun 1924, 6 Jun 1965, 6 Jun 2070.
2130, Jul 31	Apollo NEA 2020 OO1 ($H = 26.5$ mag, $D \approx 18$ m) will pass Earth at a nominal miss distance of 3.17 LD. Minimum miss distance 0.18 LD.

	See: 2020 OO1 – S2P , 2020 OO1 - JPL
2130, Aug 24	Aten NEA 2004 QA22 , ($H = 28.2$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 1.39 LD. Minimum miss distance 0.0033 LD (= 0.20 R_{Earth} from the geocenter). See: 2004 QA22 - SSA , 2004 QA22 - JPL
2131 , Mar 21	Aten NEA 2019 EA2 ($H = 25.9$ mag, $D \approx 24$ m) will pass Earth at a nominal miss distance of 1.17 LD. Minimum miss distance 0.66 LD. See: 2019 EA2 - SSA , 2019 EA2 - JPL See also: 22 Mar 2019 .
2131, Jun 17	Apollo NEA 2016 LK49 , ($H = 26.1$ mag, $D \approx 21$ m) will pass Earth at a nominal miss distance of 6.81 LD. Minimum miss distance 0.31 LD. See: 2016 LK49 - SSA , 2016 LK49- JPL
2131, Dec	Apollo NEA 2017 DQ36 ($H = 19.0$ mag, $D \approx 600$ m) will pass Earth at a nominal miss distance of 0.016 AU = 6.23 LD. See: 2017 DQ36 – SSA , 2017 DQ36 - JPL Re: - J.D. Hefele, F. Bortolussi, S. Portegies Zwart, 2020, <i>Astronomy & Astrophysics</i> , 634, 45, “Identifying Earth-impacting asteroids using an artificial neural network.” See: https://www.aanda.org/articles/aa/full_html/2020/02/aa35983-19/aa35983-19.html See also: https://www.astronomie.nl/leiden-astronomers-discover-potential-near-earth-objects-76 See also: 24 Jan 2017 , 14 Jan 2163 .
2132 , Jun 18	Apollo NEA 2018 TO1 ($H = 21.8$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 3.56 LD. Minimum miss distance 3.49 LD. See: 2018 TO1 – SSA , 2018 TO1 – JPL
2133 , Apr 5	Apollo NEA 267221 (2001 AD2 , $H = 19.7$ mag, $D \approx 562$ m, PHA) will pass Earth at a nominal miss distance of 3.41 LD. Minimum miss distance 3.41 LD. See: 2001 AD2 - JPL , 2001 AD2 - SSA See also: 3 Apr 2046 , 6 Apr 2150 .
2133, Sep 26	Apollo NEA 429584 (2011 EU29 , $H = 19.9$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 4.00 LD. Minimum miss distance 3.99 LD. See: 2011 EU29 - JPL , 2011 EU29 - SSA

2133, Oct 22	Apollo NEA 2020 FN3 ($H = 24.4$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 1.50 LD. Minimum miss distance 0.80 LD. See: 2020 FN3 – S2P , 2020 FN3 – JPL
2133, Dec 28	Aten NEA 2012 AP10 ($H = 26.5$ mag, $D \approx 18$ m) will pass Earth at a nominal miss distance of 5.97 LD. Minimum miss distance 0.30 LD. See: 2012 AP10 - SSA , 2012 AP10 - JPL
2134 , Apr 17	Apollo NEA 2019 GC6 ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 7.53 LD. Minimum miss distance 0.93 LD. See: 2019 GC6 - SSA , 2019 GC6 - JPL See also: 17 Apr 1983 , 18 Apr 2019 .
2134, Oct 8	Apollo NEA 536531 (2015 DV215 , $H = 20.4$ mag, $D \approx 290$ m, PHA) will pass Earth at a nominal miss distance of 2.91 LD. Minimum miss distance 1.88 LD. See: 2015 DV215 - JPL , 2015 DV215 - SSA See also: 6 Oct 2035 .
2134, Oct 22	Apollo NEA 2020 FN3 ($H = 24.4$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.80 LD. [2134-01] See: 2020 FN3 – S2P , 2020 FN3 – JPL See also: 2133 Oct 22 .
2135 , Aug 6	Apollo NEA 2017 BL30 ($H = 23.5$ mag, $D \approx 70$ m) will pass Earth at a nominal miss distance of 2.97 LD. Minimum miss distance 0.71 LD. See: 2017 BL30- SSA , 2017 BL30- JPL
2135, Sep 25	Apollo NEA 101955 Bennu (1999 RQ36 , $H = 20.4$ mag, $D \approx 245$ m, PHA) will pass Earth at a nominal miss distance of 0.77 LD. Minimum miss distance 0.31 LD. [2135-01] Possible Earth impact in 2182 ? See: 101955 Bennu - SSA , 1999 RQ36 - JPL See also: http://en.wikipedia.org/wiki/(101955)_1999_RQ36 See also: 22 Sep 1999 , 23 Sep 2060 .
2136 , Jan 19	Apollo NEA 2021 BO ($H = 33.0$ mag, $D \approx 0.9$ m) will pass Earth at a nominal miss distance of 1.80 LD. Minimum miss distance 0.72 LD. See: 2021 BO – S2P , 2021 BO - JPL

	See also: 18 Jan 2021 .
2136, Jan 25	Apollo NEA 523804 (2000 YF29) , $H = 20.5$ mag, $D \approx 290$ m, PHA) will pass Earth at a nominal miss distance of 4.90 LD. Minimum miss distance 4.90 LD. See: 2000 YF29 - JPL , 2000 YF29 - SSA See also: 22 Jan 2193 .
2137 , Jun 4	Aten NEA 437844 (1999 MN) , $H = 20.8$ mag, $D \approx 270$ m, PHA) will pass Earth at a nominal miss distance of 2.15 LD. Minimum miss distance 2.15 LD. See: 1999 MN - JPL , 1999 MN - SSA See also: 2 Jun 1938 , 2 Jun 1943 , 4 Jun 2110 , 3 Jun 2148 .
2139 , Jul 31	Apollo NEA 457768 (2009 KN4) , $H = 18.4$ mag, $D \approx 700$ m, PHA) will pass Earth at a nominal miss distance of 4.98 LD. Minimum miss distance 4.98 LD. See: 2009 KN4 - JPL , 2009 KN4 - SSA
2139, Sep 27	Aten NEA 2016 SU2 ($H = 27.7$ mag, $D \approx 10$ m) will pass Earth at a nominal miss distance of 0.57 LD. Minimum miss distance 0.24 LD. [2139-01] See: 2016 SU2 - SSA , 2016 SU2 - JPL See also: 24 Sep 2016 .
2139, Dec 18	Apollo NEA 2018 YM ($H = 27.1$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 0.70 LD. Minimum miss distance 0.46 LD. [2139-02] See: 2018 YM - SSA , 2018 YM - JPL
2140 , Jun 11	Apollo NEA 2021 KN1 ($H = 24.5$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 6.04 LD. Minimum miss distance 0.16 LD. See: 2021 KN1 – S2P , 2021 KN1 – JPL
2140, Jul 3	Apollo NEA 2019 AC3 ($H = 27.4$ mag, $D \approx 12$ m) will pass Earth at a nominal miss distance of 5.39 LD. Minimum miss distance 0.78 LD. See: 2019 AC3 – S2P , 2019 AC3 – JPL
2140, Dec 1	Aten NEA 153201 (2000 WO107) , $H = 19.4$ mag, $D \approx 510$ m, PHA) will pass Earth at a nominal miss distance of 0.63 LD. Minimum miss distance 0.63 LD. [2140-01] See: 153201 2000 WO107 - SSA , 2000 WO107 - JPL See also: https://en.wikipedia.org/wiki/(153201)_2000_WO107

	See also: 29 Nov 1953, 30 Nov 2093.
2141 , Feb 21	Apollo NEA 2012 DX ($H = 27.1$ mag, $D \approx 14$ m) will pass Earth at a nominal miss distance of 8.19 LD. Minimum miss distance 0.12 LD. See: 2012 DX - SSA , 2012 DX - JPL
2141, May 8	Aten NEA 525498 (2005 GE60) , $H = 22.2$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 2.06 LD. Minimum miss distance 2.06 LD. See: 2005 GE60 – SSA , 2005 GE60 – JPL
2141, Jul 8	Aten NEA 2016 NJ22 ($H = 28.2$ mag, $D \approx 8$ m) will pass Earth at a nominal miss distance of 4.12 LD. Minimum miss distance 0.44 LD. See: 2016 NJ22 - SSA , 2016 NJ22 - JPL See also: 7 July 2016.
2141, Sep 4	Apollo NEA 196625 (2003 RM10) , $H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 3.17 LD. Minimum miss distance 3.17 LD. See: 2003 RM10 - JPL , 2003 RM10 - SSA
2141, Nov 16	Apollo NEA 2016 VX1 ($H = 25.3$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 6.83 LD. Minimum miss distance 0.11 LD. See: 2016 VX1 - SSA , 2016 VX1 - JPL
2142 , Nov 29	Apollo NEA 2017 WN16 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 4.74 LD. Minimum miss distance 3.99 LD. See: 2017 WN16 - JPL , 2017 WN16 - SSA
2142, Dec 10	Aten NEA 2015 YU7 ($H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 4.56 LD. Minimum miss distance 4.56 LD. See: 2015 YU7 - JPL , 2015 YU7 - SSA See also: 10 Dec 2174.
2143 , Mar 6	Apollo NEA 474158 (1999 FA) , $H = 20.9$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.90 LD. Minimum miss distance 4.62 LD. See: 1999 FA - JPL , 1999 FA - SSA See also: 6 Mar 1909, 6 Mar 1999, 7 Mar 2194.
2143, May 28	Apollo NEA 2021 LV ($H = 27.9$ mag, $D \approx 9$ m) will pass Earth at a nominal miss distance of 3.31 LD. Minimum miss distance 0.95 LD. See: 2021 LV – S2P , 2021 LV – JPL

	See also: 27 May 2021 .
2143, Nov 6	Apollo NEA 2015 JJ ($H = 22.1$ mag, $D \approx 140$ m) will pass Earth at a nominal miss distance of 4.93 LD. Minimum miss distance 0.74 LD. See: 2015 JJ – S2P , 2015 JJ – JPL
2143, Dec 7	Apollo NEA 2020 XE1 ($H = 26.7$ mag, $D \approx 16$ m) will pass Earth at a nominal miss distance of 3.84 LD. Minimum miss distance 0.42 LD. See: 2020 XE1 – S2P , 2020 XE1 – JPL See also: 3 Dec 2020 .
2145 , Nov 2	Aten NEA 2019 UN13 ($H = 32.2$ mag, $D \approx 1.3$ m) will pass Earth at a nominal miss distance of 3.42 LD. Minimum miss distance 0.57 LD. See: 2019 UN13 – SSA , 2019 UN13 - JPL See also: 31 Oct 2019 .
2146 , Mar 23	Apollo NEA 2009 DO111 ($H = 22.6$ mag, $D \approx 110$ m) will pass Earth at a nominal miss distance of 0.88 LD. Minimum miss distance 0.74 LD. [2146-01] See: 2009 DO111 - SSA , 2009 DO111 - JPL
2146, Sep 19	Aten NEA 2021 SU1 ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 4.86 LD. Minimum miss distance 0 LD . See: 2021 SU1 – S2P , 2021 SU1 - JPL
2147 , Oct 9	Apollo NEA 2018 EB ($H = 22.0$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 3.96 LD. Minimum miss distance 3.94 LD. See: 2018 EB - JPL , 2018 EB - SSA
2148 , Jan 22	Apollo NEA 85640 (1998 OX4 = 2002 PJ34 , $H = 20.9$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 0.77 LD. Minimum miss distance 0.77 LD. [2148-01] See: 85640 1998 OX4 - SSA , 1998 OX4 - JPL See also: https://en.wikipedia.org/wiki/(85640)_1998_OX4 See also: 18 Jan 1985 .
2148, May 7	Apollo NEA 144898 (2004 VD17 , $H = 19.0$ mag, $D \approx 320$ m, PHA) will pass Earth at a nominal miss distance of 16.5 LD. Minimum miss distance 5.7 LD. See: 144898 2004 VD17 - SSA , 2004 VD17 - JPL Ref:

	- F. de Luise, D. Perna, E. Dotto, et al., 2007, <i>Icarus</i>, 191, 628, "Physical investigation of the potentially hazardous asteroid (144898) 2004 VD17." See: http://adsabs.harvard.edu/abs/2007Icar..191..628D See also: http://en.wikipedia.org/wiki/(144898)_2004_VD17 See also: 7 Nov 2041, 5 May 2196.
2148, Jun 3	Aten NEA 437844 (1999 MN, $H = 20.8$ mag, $D \approx 250$ m, PHA) will pass Earth at a nominal miss distance of 3.29 LD. Minimum miss distance 3.28 LD. See: 1999 MN - JPL, 1999 MN - SSA See also: 2 Jun 1938, 2 Jun 1943, 4 Jun 2110, 4 Jun 2137.
2148, Dec 26	Apollo NEA 2018 FQ4 ($H = 27.2$ mag, $D \approx 13$ m) will pass Earth at a nominal miss distance of 1.65 LD. Minimum miss distance 0.0011 LD (= 0.068 R_{Earth} from the geocenter). See: 2018 FQ4 - SSA , 2018 FQ4 - JPL
2149 , May 28	Aten NEA 2017 JF3 ($H = 22.0$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 3.58 LD. Minimum miss distance 3.44 LD. See: 2017 JF3 – SSA , 2017 JF3 – JPL See also: 28 May 2168.
2149, Dec 1	Aten NEA 2019 OV3 ($H = 24.3$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 0.96 LD. Minimum miss distance 0.69 LD. [2149-01] See: 2019 OV3 – S2P , 2019 OV3 – JPL
2149, Dec 7	Apollo NEA 279744 (1998 KM3, $H = 20.2$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 3.52 LD. Minimum miss distance 3.52 LD. See: 1998 KM3 - JPL , 1998 KM3 - SSA
2150 , Apr 6	Apollo NEA 267221 (2001 AD2, $H = 19.7$ mag, $D \approx 562$ m, PHA) will pass Earth at a nominal miss distance of 4.82 LD. Minimum miss distance 4.76 LD. See: 2001 AD2 - JPL , 2001 AD2 - SSA See also: 3 Apr 2046, 5 Apr 2133.
2150, Sep 10	Apollo NEA 387668 (2002 SZ, $H = 20.4$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 4.29 LD. Minimum miss distance 4.27 LD. See: 2002 SZ - JPL, 2002 SZ - SSA See also: 10 Sep 2067.

2151, Nov 10	Aten NEA 2018 VR3 ($H = 26.1$ mag, $D \approx 21$ m) will pass Earth at nominal miss distance of 7.18 LD. Minimum miss distance 0.63 LD. See: 2018 VR3 - SSA , 2018 VR3 - JPL
2152, Jan 27	Apollo NEA 2020 TB12 ($H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 1.74 LD. Minimum miss distance 1.47 LD. See: 2020 TB12 – S2P , 2020 TB12 - JPL
2153, Sep 21	Apollo NEA 1997 GL3 , $H = 19.1$ mag, $D \approx 200$ m, PHA) will pass Earth at a nominal miss distance of 2.02 LD. Minimum miss distance 2.02 LD. See: 1997 GL3 - JPL , 1997 GL3 - SSA
2154, May 9	Aten NEA 525498 (2005 GE60) , $H = 22.2$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 5.11 LD. Minimum miss distance 5.00 LD. See: 2005 GE60 - JPL , 2005 GE60 - SSA
2154, Jun 14	Amor NEA 2020 DB5 ($H = 19.3$ mag, $D \approx 500$ m, PHA) will pass Earth at a nominal miss distance of 8.94 LD. Minimum miss distance 4.92 LD. See: 2020 DB5 – S2P , 2020 DB5 - JPL
2155, Jun 16	Apollo NEA 530520 (2011 LT17) , $H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at a nominal miss distance of 1.75 LD. Minimum miss distance 1.74 LD. See: 2011 LT17 - JPL , 2011 LT17 - SSA See also: 15 Jun 2011, 16 Dec 2156.
2155, Aug 5	Apollo NEA 2018 PY7 ($H = 26.9$ mag, $D \approx 15$ m) will pass Earth at a nominal miss distance of 0.31 LD. Minimum miss distance 0.30 LD. [2155-01] See: 2005 GE60 - JPL , 2005 GE60 - SSA
2156, May 17	Apollo NEA 2010 WC9 ($H = 23.8$ mag, $D \approx 60$ m) will pass Earth at a nominal miss distance of 12.49 LD. Minimum miss distance 0.49 LD. See: 2010 WC9 - SSA , 2010 WC9 - JPL See also: https://en.wikipedia.org/wiki/2010_WC9 See also: 15 May 2018, 15 May 2102.
2156, Dec 16	Apollo NEA 530520 (2011 LT17) , $H = 21.6$ mag, $D \approx 170$ m, PHA) will pass Earth at nominal miss distance of 0.98 LD. Minimum miss distance 0.96 LD.

	[2156-01] See: 2011 LT17 - SSA , 2011 LT17 - JPL See also: 15 Jun 2011, 16 Jun 2155.
2157 , Jan 1	Aten NEA 2012 XE133 ($H = 23.3$ mag, $D \approx 80$ m) will pass Earth at a nominal miss distance of 0.69 LD. Minimum miss distance 0.69 LD. [2157-01] See: 2012 XE133 – S2P , 2012 XE 133 – JPL
2158 , May 15	Apollo NEA 2000 KA ($H = 21.9$ mag, $D \approx 150$ m, PHA) will pass Earth at a nominal miss distance of 8.67 LD. Minimum miss distance 8.64 LD. See: 2000 KA - SSA , 2000 KA - JPL See also: 12 May 2020, 27 Nov 2128.
2158, Nov 6	Apollo NEA 2012 TY52 ($H = 21.3$ mag, $D \approx 190$ m, PHA) will pass Earth at a nominal miss distance of 4.11 LD. Minimum miss distance 3.99 LD. See: 2012 TY52 - JPL, 2012 TY52 - SSA See also: 4 Nov 1982.
2158, Dec 20	Apollo NEA 2015 BW310 ($H = 22.2$ mag, $D \approx 130$ m) will pass Earth at a nominal miss distance of 4.51 LD. Minimum miss distance 3.32 LD. See: 2015BW310 - SSA , 2015 BW310 - JPL
2158, Dec 25	Apollo NEA 2020 YA3 ($H = 26.1$ mag, $D \approx 22$ m) will pass Earth at a nominal miss distance of 6.60 LD. Minimum miss distance 0.0000085 LD (= 0.0005 R_{Earth} from the geocenter). See: 2020 YA3 – S2P , 2020 YA3 – JPL
2159 , May 4	Aten NEA 467460 (2006 JF42, $H = 19.0$ mag, $D \approx 600$ m, PHA) will pass Earth at a nominal miss distance of 2.87 LD. Minimum miss distance 2.87 LD. See: 2006 JF42 - JPL , 2006 JF42 - SSA
2160 , Mar 23	Apollo NEA 434734 (2006 FX, $H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 4.38 LD. Minimum miss distance 4.36 LD. See: 2006 FX - JPL , 2006 FX - SSA
2161 , Feb 8	Apollo NEA 2013 VA10 ($H = 22.4$ mag, $D \approx 120$ m) will pass Earth at a nominal miss distance of 5.42 LD. Minimum miss distance 3.87 LD. See: 2013 VA10 – SSA , 2013 VA10 – JPL

	See also: 6 Feb 1944, 7 Feb 2040.
2161, Nov 6	Apollo NEA 2011 VU5 ($H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 5.95 LD. Minimum miss distance 1.81 LD. See: 2011 VU5 - JPL , 2011 VU5 - SSA
2161, Dec 8	Aten NEA 2019 YA3 ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 4.62 LD. Minimum miss distance 0.93 LD. See: 2019 YA3 – S2P , 2019 YA3 – JPL
2162 , 13 Apr	Apollo NEA 2020 GA2 ($H = 21.1$ mag, $D \approx 210$ m, PHA) will pass Earth at a nominal miss distance of 9.02 LD. Minimum miss distance 7.32 LD. See: 2020 GA2 – S2P , 2020 GA2 - JPL See also: 11 Apr 2020.
2162, Jun 1	Aten NEA 2017 HZ4 ($H = 25.9$ mag, $D \approx 23$ m) will pass Earth at nominal miss distance of 0.95 LD. Minimum miss distance 0.17 LD. [2162-01] See: 2017 HZ4 - SSA , 2017 HZ4 - JPL
2163, Jan 14	Apollo NEA 2017 DQ36 ($H = 19.0$ mag, $D \approx 600$ m) will pass Earth at a nominal miss distance of 89.4 LD. Minimum miss distance 73.7 LD See: 2017 DQ36 – SSA , 2017 DQ36 - JPL Re: - J.D. Hefele, F. Bortolussi, S. Portegies Zwart, 2020, <i>Astronomy & Astrophysics</i> , 634, 45, “Identifying Earth-impacting asteroids using an artificial neural network.” See: https://www.aanda.org/articles/aa/full_html/2020/02/aa35983-19/aa35983-19.html See also: https://www.astronomie.nl/leiden-astronomers-discover-potential-near-earth-objects-76 See also: 24 Jan 2017, 2131 Dec.
2163, Dec 14	Apollo NEA 162474 (2000 LB16) , $H = 18.7$ mag, $D \approx 600$ m, PHA) will pass Earth at a nominal miss distance of 4.29 LD. Minimum miss distance 4.29 LD. See: 2000 LB16 - JPL , 2000 LB16 - SSA
2165 , Sep	Apollo NEA 2014 TW57 ($H = 19.7$ mag, $D \approx 470$ m) will pass Earth at a nominal miss distance of 0.017 AU = 6.62 LD. See: 2014 TW57 – SSA , 2014 TW57 – JPL Re: - J.D. Hefele, F. Bortolussi, S. Portegies Zwart, 2020, <i>Astronomy &</i>

	<i>Astrophysics</i>, 634, 45, "Identifying Earth-impacting asteroids using an artificial neural network." See: https://www.aanda.org/articles/aa/full_html/2020/02/aa35983-19/aa35983-19.html See also: https://www.astronomie.nl/leiden-astronomers-discover-potential-near-earth-objects-76 See also: 20 Oct 2014.
2165, Oct 21	Aten NEA 2007 US12, $H = 21.9$ mag, $D \approx 150$ m, PHA) will pass Earth at a nominal miss distance of 4.27 LD. Minimum miss distance 4.27 LD. See: 2007 US12 - JPL , 2007 US12 - SSA
2166 , Feb 3	Apollo NEA 4660 Nereus (1982 DB, $H = 18.8$ mag, $D \approx 510 \times 330 \times 240$ m, PHA) will pass Earth at 7.28 LD. Minimum miss distance 6.73 LD. See: 4660 Nereus - SSA , 1982 DB - JPL Ref: - M. Brozovic, S.J. Ostro, L.A.M. Benner, et al., 2009, <i>Icarus</i>, 201, 153, "Radar observations and a physical model of asteroid 4660 Nereus, a prime space mission target." See: http://adsabs.harvard.edu/abs/2009Icar..201..153B See also: http://en.wikipedia.org/wiki/4660_Nereus See also: 29 Jan 1900, 22 Jan 2002, 11 Dec 2021, 14 Feb 2060, 4 Feb 2071, 23 Dec 2112.
2166, Jun 14	Amor NEA 423321 (2005 ED318, $H = 20.7$ mag, $D \approx 202$ m, PHA) will pass Earth at a nominal miss distance of 4.43 LD. Minimum miss distance 4.43 LD. See: 2005 ED318 - JPL, 2005 ED318 - SSA See also: 2 Jun 2083.
2167 , Apr 9	Apollo NEA 25143 Itokawa (1998 SF36, $H = 19.1$ mag, $D = 520 \times 270 \times 230$ m, $M = 3.6 \times 10^{10}$ kg, PHA) will pass Earth at a nominal miss distance of 9.78 LD. Minimum miss distance 9.76 LD. See: 25143 Itokawa - SSA , 1998 SF36 - JPL See also: https://en.wikipedia.org/wiki/25143_Itokawa See also: 27 Jun 1905, 26 Jun 2004.
2167, Jun 22	Apollo NEA 162416 (2000 EH26, $H = 21.7$ mag, $D = 141$ m, PHA) will pass Earth at a nominal miss distance of 3.55 LD. Minimum miss distance 2.34 LD. See: 2000 EH26 - SSA , 2000 EH26 - JPL See also: 21 Apr 2106.

2168, Jan 30	Asteroid 2007 TU24 ($H = 20.5$ mag, $D = 250$ m, PHA) will pass Earth at a nominal miss distance of 3.79 LD. Minimum miss distance 0.90 LD. See: 2007 TU24 - SSA , 2007 TU24 - JPL See also: https://en.wikipedia.org/wiki/2007_TU24 See also: 29 Jan 2008 .
2168, May 28	Aten NEA 2017 JF3 ($H = 22.0$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 3.96 LD. Minimum miss distance 3.20 LD. See: 2017 JF3 - SSA , 2017 JF3 - JPL See als: 28 May 2149 .
2168, Nov 1	Apollo NEA 374158 (2004 UL , $H = 18.7$ mag, $D \approx 600$ m, PHA) will pass Earth at a nominal miss distance of 3.24 LD. Minimum miss distance 2.99 LD. See also: https://en.wikipedia.org/wiki/(374158)_2004_UL See: 2004 UL - JPL , 2004 UL - SSA
2169, Feb 9	Apollo NEA 2018 DA1 , $H = 19.0$ mag, $D = 600$ m, PHA) will pass Earth at a nominal miss distance of 3.78 LD. Minimum miss distance 3.76 LD. See: 2018 DA1 - SSA , 2018 DA1 - JPL
2169, Jul 29	Apollo NEA 2014 SP142 , $H = 21.8$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 6.43 LD. Minimum miss distance 0.41 LD. See: 2014 SP142 - JPL , 2014 SP142 - SSA
2169, Aug 23	Aten NEA 3362 Khufu (1984 QA , $H = 17.5$ mag, $D \approx 700$ m, PHA) will pass Earth at a nominal miss distance of 4.38 LD. Minimum miss distance 4.25 LD. See: 1984 QA - JPL , 1984 QA - SSA See also: https://en.wikipedia.org/wiki/3362_Khufu
2172, Feb 8	Apollo NEA 276033 (2002 AJ129 , $H = 19.1$ mag, $D \approx 500$ m, PHA) will pass Earth at a nominal miss distance of 1.78 LD. Minimum miss distance 1.77 LD. See: 2002 AJ129 - JPL , 2002 AJ129 - SSA See also: https://en.wikipedia.org/wiki/(276033)_2002_AJ129
2172, Mar 7	Apollo NEA 2007 ED125 ($H = 21.3$ mag, $D = 200$ m, PHA) will

	pass Earth at a nominal miss distance of 4.64 LD. Minimum miss distance 4.63 LD. See: 2007 ED125 - SSA , 2007 ED125 - JPL
2174, Jul 16	Apollo NEA 2019 NB7 ($H = 27.3$ mag, $D = 13$ m) will pass Earth at a nominal miss distance of 0.65 LD. Minimum miss distance 0.021 LD (= 1.27 R_{Earth} from the geocenter). [2174-01] See: 2019 NB7 - SSA , 2019 NB7 - JPL
2174, Dec 10	Aten NEA 2015 YU7 ($H = 21.6$ mag, $D = 170$ m, PHA) will pass Earth at a nominal miss distance of 3.53 LD. Minimum miss distance 3.53 LD. See: 2015 YU7 - SSA , 2015 YU7 - JPL See also: 10 Dec 2142.
2175, May 1	Apollo NEA 164121 (2003 YT1 , $H = 16.4$ mag, $D \approx 1100$ m, PHA) will pass Earth at a nominal miss distance of 6.35 LD. Minimum miss distance 6.15 LD. See: 164121 2003 YT1 - SSA , 2003 YT1 - JPL See also: https://en.wikipedia.org/wiki/(164121)_2003_YT1 See also: 29 Apr 2073.
2175, Aug 3	Aten NEA 2021 PH2 ($H = 21.6$ mag, $D \approx 180$ m, PHA) passed Earth at a nominal miss distance of 6.92 LD. Minimum miss distance 6.82 LD. See: 2021 PH2 – S2P , 2021 PH2 – JPL See also: 1 Aug 2021.
2175, Aug 19	Apollo NEA 2017 RV ($H = 22.1$ mag, $D \approx 140$ m, PHA) will pass Earth at a nominal miss distance of 4.81 LD. Minimum miss distance 3.46 LD. See: 2017 RV – SSA , 2017 RV – JPL See also: 17 Aug 1979, 19 Aug 2125.
2176, Apr 12	Apollo NEA 2021 GW4 ($H = 29.5$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 2.19 LD. Minimum miss distance 0.89 LD. See: 2021 GW4 – S2P , 2021 GW4 - JPL See also: 12 Apr 2021.
2176, Apr 28	Apollo NEA 2012 HM ($H = 24.4$ mag, $D \approx 50$ m) will pass Earth at a nominal miss distance of 4.67 LD. Minimum miss distance 0.13 LD. See: 2012 HM - SSA , 2012 HM - JPL
2177, Jan 28	Apollo NEA 2017 BA7 ($H = 27.8$ mag, $D \approx 10$ m) will pass Earth at

	a nominal miss distance of 1.80 LD. Minimum miss distance 0.80 LD. See: 2017 BA7 - SSA , 2017 BA7 - JPL
2177, Mar 24	Aten NEA 2016 BC14 ($H = 21.1$ mag, $D \approx 210$ m, PHA), will pass Earth at a nominal miss distance of 3.24 LD. Minimum miss distance 2.92 LD. See: 2016 BC14 – SSA , 2016 BC14 – JPL
2177, Mar 29	Apollo NEA 374851 (2006 VV2) ($H = 16.9$ mag, $D \approx 1800$ m, PHA) will pass Earth at a nominal miss distance of 12.4 LD. Minimum miss distance 12.4 LD. See: 374851 2006 VV2 - SSA , 2006 VV2 - JPL See also: 31 Mar 2007 .
2177, Nov 11	Aten NEA 2017 XS2 ($H = 26.0$ mag, $D \approx 22$ m) will pass Earth at a nominal miss distance of 1.26 LD. Minimum miss distance 0.02 LD. See: 2017 XS2 - SSA , 2017 XS2 - JPL
2178 , Apr 19	Apollo NEA 2013 CE129 ($H = 22.4$ mag, $D \approx 120$ m), will pass Earth at a nominal miss distance of 3.86 LD. Minimum miss distance 3.86 LD. See: 2013 CE129 – SSA , 2013 CE129 - JPL
2178, Nov 21	Aten NEA 2019 OR1 ($H = 21.1$ mag, $D \approx 220$ m, PHA), will pass Earth at a nominal miss distance of 3.52 LD. Minimum miss distance 3.52 LD. See: 2019 OR1 - JPL , 2019 OR1 - SSA See also: 19 Nov 1902 , 20 Nov 2085 , 21 Nov 2100 .
2179 , Feb 4	Aten NEA 2020 CA ($H = 29.4$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 5.65 LD. Minimum miss distance 0.08 LD. See: 2020 CA – S2P , 2020 CA – JPL See also: 2 Feb 2020 .
2179, Apr 13	Apollo NEA 2016 FV13 ($H = 26.0$ mag, $D \approx 23$ m) will pass Earth at a nominal miss distance of 1.17 LD. Minimum miss distance 0.52 LD. See: 2016 FV13 - SSA , 2016 FV13 - JPL
2179, Dec 28	Apollo NEA 452302 (1995 YR1) ($H = 20.6$ mag, $D = 270$ m, PHA) will pass Earth at a nominal miss distance of 4.07 LD. Minimum miss distance 3.95 LD. See: 1995 YR1 - SSA , 1995 YR1 - JPL
2180 , Oct 10	Apollo NEA 2018 QT ($H = 21.1$ mag, $D \approx 220$ m, PHA) will pass

	Earth at a nominal miss distance of 4.83 LD. Minimum miss distance 4.76 LD. See: 2018 QT – SSA , 2018 QT – JPL See also: 8 Oct 2073.
2181 , Feb 9	Apollo NEA 523606 (2005 CJ, $H = 20.3$ mag, $D = 300$ m, PHA) will pass Earth at a nominal miss distance of 4.16 LD. Minimum miss distance 4.16 LD. See: 2005 CJ - SSA , 2005 CJ - JPL
2181, Mar 2	Apollo NEA 162162 (1999 DB7, $H = 19.9$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 9.96 LD. Minimum miss distance 0.13 LD. See: 1999 DB7 – S2P , 1999 DB7 – JPL
2181, Jun 25	Apollo NEA 441987 (2010 NY65, $H = 21.4$ mag, $D \approx 228$ m, PHA) will pass Earth at a nominal miss distance of 8.49 LD. Minimum miss distance 8.49 LD. See: 2010 NY65- SSA , 2010 NY65 - JPL See also: 24 Jun 2017, 24 Jun 2018, 24 Jun 2019, 24 Jun 2020
2181, Dec 29	Aten NEA 2019 AQ2 ($H = 25.7$ mag, $D \approx 26$ m) will pass Earth at a nominal miss distance of 4.51 LD. Minimum miss distance 0.63 LD. See: 2019 AQ2 – SSA , 2019 AQ2 - JPL
2183 , Jan 12	Apollo NEA 332446 (2008 AF4, $H = 19.7$ mag, $D = 400$ m, PHA) will pass Earth at a nominal miss distance of 5.74 LD. Minimum miss distance 5.68 LD. See: 332446 2008 AF4 - SSA , 2008 AF4 - JPL See also: http://en.wikipedia.org/wiki/2008_AF4
2184 , Sep 10	Aten NEA 523950 (1998 SZ27, $H = 20.5$ mag, $D = 280$ m, PHA) will pass Earth at a nominal miss distance of 3.04 LD. Minimum miss distance 3.03 LD. See: 1998 SZ27 - SSA , 1998 SZ27 - JPL
2185 , Feb 20	Aten NEA 2019 BE5 ($H = 25.1$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 6.77 LD. Minimum miss distance 0.19 LD. See: 2019 BE5 – SSA , 2019 BE5 - JPL
2185, Mar 29	Apollo NEA 410777 (2009 FD, $H = 22.3$ mag, $D \approx 472$ m, PHA) will pass Earth at a nominal miss distance of 13.16 LD. Minimum miss distance 6.16 LD. See: 410777 2009 FD - SSA , 2009 FD - JPL Ref:

	- F. Spoto, A. Milani, D. Farnocchia, S.R. Chesley, M. Micheli, G.B. Valsecchi, D. Perna, O. Hainaut, 2014, <i>Astronomy & Astrophysics</i>, 572, 100, "Non-gravitational perturbations and virtual impactors: the case of asteroid 2009 FD." See: http://adsabs.harvard.edu/abs/2014A%26A...572A.100S See also: http://www.space.com/12645-asteroid-deflection-doomsday-earth-capability.html http://www.eso.org/public/announcements/ann14004/ http://neo.ssa.esa.int/ http://www.esa.int/Our_Activities/Operations/Space_Situational_Awareness/European_cooperation_reduces_asteroid_risk http://en.wikipedia.org/wiki/2009_FD See also: 27 Mar 2009.
2185, Jul 22	Aten NEO 2017 OO1 ($H = 24.7$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 1.14 LD. Minimum miss distance 0.15 LD. See: 2017 OO1 - SSA , 2017 OO1 - JPL See also: https://watchers.news/2017/07/25/asteroid-2017-oo1/ http://earthsky.org/space/asteroid-2017-oo1-close-pass-undetected https://en.wikipedia.org/wiki/2017_OO1 See also: 21 July 2017
2185, Aug 4	Apollo NEA 2011 EL11 ($H = 19.9$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 3.09 LD. Minimum miss distance 2.86 LD. See: 2011 EL11 - SSA , 2011 EL11 - JPL
2186 , Jun 17	Apollo NEA 152685 (1998 MZ), ($H = 19.4$ mag, $D \approx 500$ m, PHA) will pass Earth at a nominal miss distance of 19.55 LD. Minimum miss distance 0.48 LD. See: 152685 1998 MZ - SSA , 1998 MZ - JPL See also: 13 Jun 2175.
2186, Jul 16	Apollo NEA 314082 Dryope (2005 CZ36), ($H = 17.4$ mag, $D \approx 1200$ m, PHA) will pass Earth at a nominal miss distance of 3.56 LD. Minimum miss distance 2.95 LD. See: 314082 2005 CZ36 - SSA , 2005 CZ36 - JPL
2187 , Sep 2	Aten NEA 2017 RH16 ($H = 26.2$ mag, $D \approx 20$ m) will pass Earth at a nominal miss distance of 7.24 LD. Minimum miss distance 0.54 LD. See: 2017 RH16 - SSA , 2017 RH16 - JPL
2189 , Jan 21	Apollo NEA 2011 BM45 ($H = 21.7$ mag, $D \approx 160$ m, PHA) will pass Earth at a nominal miss distance of 4.76 LD. Minimum miss distance 4.76 LD. See: 2011 BM45 - SSA , 2011 BM45 - JPL

2189, Oct 3	Apollo NEA 360191 (1988 TA , $H = 20.0$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 4.67 LD. Minimum miss distance 4.03 LD. See: 1988 TA - SSA , 1988 TA - JPL See also: 29 Sep 1988 , 30 Sep 2053 .
2189, Oct 27	Apollo NEA 2011 WL2 ($H = 20.7$ mag, $D \approx 250$ m, PHA) will pass Earth at a nominal miss distance of 2.34 LD. Minimum miss distance 0.16 LD. See: 2011 WL2 - SSA , 2011 WL2 - JPL
2189, Nov 18	Aten NEA 2009 WQ6 ($H = 29.1$ mag, $D \approx 5$ m) will pass Earth at a nominal miss distance of 0.82 LD. Minimum miss distance 0.14 LD. [2189-01] See: 2009 WQ6 - SSA , 2009 WQ6 - JPL See also: 16 Nov 2009 .
2190 , May 21	Apollo NEA 452807 (2006 KV89 , $H = 21.8$ mag, $D = 160$ m, PHA) will pass Earth at a nominal miss distance of 4.48 LD. Minimum miss distance 4.41 LD. See: 2006 KV89 - SSA , 2006 KV89 - JPL
2190, Nov 22	Aten NEA 413577 (2005 UL5 , $H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 6.29 LD. Minimum miss distance 6.28 LD. See: 413577 2005 UL5 - SSA , 2005 UL5 - JPL See also: 23 Nov 2200 .
2191 , Jan 11	Aten NEA 2018 AM12 ($H = 20.9$ mag, $D \approx 230$ m, PHA) will pass Earth at a nominal miss distance of 4.13 LD. Minimum miss distance 2.94 LD. See: 2018 AM12 - JPL , 2018 AM12 - SSA See also: 9 Jan 1982 .
2191, Feb 19	Aten NEA 2018 CW2 ($H = 25.7$ mag, $D = 25$ m) will pass Earth at a nominal miss distance of 3.83 LD. Minimum miss distance 0.08 LD. See: 2018 CW2 - SSA , 2018 CW2 - JPL See also: 19 Feb 2193 .
2192 , Feb 15	Apollo NEA 2007 PV27 ($H = 20.5$ mag, $D = 300$ m, PHA) will pass Earth at a nominal miss distance of 2.25 LD. Minimum miss distance 2.24 LD. See: 2007 PV27 - SSA , 2007 PV27 - JPL
2192, Aug 21	Apollo NEA 137126 (1999 CF9 , $H = 18.2$ mag, $D \approx 900$ m, PHA)

	will pass Earth at a nominal miss distance of 4.97 LD. Minimum miss distance 4.97 LD. See: 137126 1999 CF9 - SSA , 1999 CF9 - JPL
2193, Jan 23	Apollo NEA 523804 (2000 YF29 , $H = 20.5$ mag, $D = 290$ m, PHA) will pass Earth at a nominal miss distance of 2.59 LD. Minimum miss distance 2.59 LD. See: 2000 YF29 - SSA , 2000 YF29 - JPL See also: 25 Jan 2136 .
2193, Feb 19	Aten NEA 2018 CW2 ($H = 25.7$ mag, $D = 25$ m) will pass Earth at a nominal miss distance of 2.13 LD. Minimum miss distance 0.00090 LD (= 0.054 R_{Earth} from the geocenter) . See: 2018 CW2 - SSA , 2018 CW2 - JPL See also: 19 Feb 2191 .
2193, Mar 21	Apollo NEA 354182 (2002 DU3 , $H = 20.6$ mag, $D = 270$ m, PHA) will pass Earth at a nominal miss distance of 1.59 LD. Minimum miss distance 1.53 LD. See: 2002 DU3 - SSA , 2002 DU3 - JPL
2193, Apr 25	Apollo NEA 2017 KN34 ($H = 19.7$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 9.52 LD. Minimum miss distance 0.95 LD. See: 2017 KN34 - S2P , 2017 KN34 - JPL
2194, Feb 13	Aten NEA 2009 BE58 ($H = 21.8$ mag, $D = 150$ m, PHA) will pass Earth at a nominal miss distance of 2.53 LD. Minimum miss distance 2.48 LD. See: 2009 BE58 - SSA , 2009 BE58 - JPL See also: 10 Feb 1950 , 11 Feb 2058 .
2194, Mar 8	Apollo NEA 474158 (1999 FA , $H = 20.9$ mag, $D = 300$ m, PHA) will pass Earth at a nominal miss distance of 9.19 LD. Minimum miss distance 1.04 LD. See: 1999 FA - SSA , 1999 FA - JPL See also: 6 Mar 1909 , 6 Mar 1999 , 6 Mar 2143 .
2194, Nov 2	Aten NEA 2019 VV ($H = 25.3$ mag, $D \approx 30$ m) will pass Earth at a nominal miss distance of 3.13 LD. Minimum miss distance 0.25 LD. See: 2019 VV - S2P , 2019 VV - JPL
2194, Nov 16	Apollo NEA 374855 (2006 VQ13 , $H = 19.9$ mag, $D \approx 400$ m, PHA) will pass Earth at a nominal miss distance of 2.31 LD. Minimum miss distance 2.31 LD. See: 374855 2006 VQ13 - SSA , 2006 VQ13 - JPL

2196 , Mar 26	Apollo NEA 2017 FZ2 ($H = 26.6$ mag, $D \approx 17$ m) will pass Earth at a nominal miss distance of 6.22 LD. Minimum miss distance 0.69 LD. See: 2017 FZ2 - SSA , 2017 FZ2 - JPL See also: https://en.wikipedia.org/wiki/2017_FZ2
2196, May 5	Apollo NEA 144898 (2004 VD17 , $H = 19.0$ mag, $D \approx 320$ m, PHA) will pass Earth at a nominal miss distance of 2.59 LD. Minimum miss distance 1.72 LD. See: 2004 VD17 - SSA , 2004 VD17 - JPL See also: https://en.wikipedia.org/wiki/(144898)_2004_VD17 See also: 7 Nov 2041 , 7 May 2148 .
2196, Jul 11	Apollo NEA 2017 MC4 ($H = 22.0$ mag, $D \approx 140$ m) will pass Earth at a nominal miss distance of 5.39 LD. Minimum miss distance 1.11 LD. See: 2017 MC4 – SSA , 2017 MC4 - JPL
2197 , Mar 13	Aten NEA 2021 EL4 ($H = 25.8$ mag, $D \approx 24$ m) will pass Earth at a nominal miss distance of 1.001 LD. Minimum miss distance 0.58 LD. See: 2021 EL4 – S2P , 2021 EL4 – JPL
2197, Apr 22	Apollo NEA 2013 WT45 ($H = 20.4$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 2.45 LD. Minimum miss distance 0.90 LD. See: 2013 WT45 - SSA , 2013 WT45 - JPL
2197, Jun 11	Amor NEA 2018 EJ4 ($H = 21.4$ mag, $D \approx 190$ m, PHA) will pass Earth at a nominal miss distance of 4.81 LD. Minimum miss distance 4.56 LD. See: 2018 EJ4 - SSA , 2018 EJ4 - JPL See also: 10 Jun 2018 .
2197, Oct 23	Apollo NEA 2014 SM143 , ($H = 20.4$ mag, $D \approx 290$ m, PHA) will pass Earth at a nominal miss distance of 1.95 LD. Minimum miss distance 0.36 LD. See: 2014 SM143 - SSA , 2014 SM143 - JPL See also: 20 Apr 1934 , 19 Apr 2093 .
2198 , Mar 18	Apollo NEA 2015 PM ($H = 20.3$ mag, $D \approx 300$ m, PHA) will pass Earth at a nominal miss distance of 3.22 LD. Minimum miss distance 3.21 LD. See: 2015 PM - SSA , 2015 PM - JPL See also: 16 Mar 2077 .

2198, Mar 25	Apollo NEA 2011 FV6 ($H = 24.9$ mag, $D \approx 40$ m) will pass Earth at a nominal miss distance of 3.85 LD. Minimum miss distance 0.93 LD. See: 2011 FV6 - SSA , 2011 FV6 - JPL
2198, May 5	Apollo NEA 290772 (2005 VC) , $H = 17.4$ mag, $D \approx 1200$ m, PHA) will pass Earth at a nominal miss distance of 1.97 LD. Minimum miss distance 1.81 LD. See: 290772 2005 VC - SSA , 2005 VC - JPL
2199, Apr 22	Apollo NEA 2014 YS34 ($H = 20.7$ mag, $D = 260$ m, PHA) will pass Earth at a nominal miss distance of 4.68 LD. Minimum miss distance 4.62 LD. See: 2014 YS34 - SSA , 2014 YS34 - JPL
2199, Jul 6	Apollo NEA 2020 NB ($H = 26.3$ mag, $D \approx 20$ m) will pass Earth at a nominal miss distance of 7.55 LD. Minimum miss distance 0.47 LD. See: 2020 NB – S2P , 2020 NB – JPL See also : 5 Jul 2020 .
2200, Nov 1	Aten NEA 475534 (2006 TS7) , $H = 21.3$ mag, $D = 200$ m, PHA) will pass Earth at a nominal miss distance of 4.47 LD. Minimum miss distance 4.47 LD. See: 2006 TS7 - SSA , 2006 TS7 - JPL See also: 29 Oct 2018 .
2200, Nov 23	Aten NEA 413577 (2005 UL5) , $H = 20.5$ mag, $D \approx 280$ m, PHA) will pass Earth at a nominal miss distance of 5.84 LD. Minimum miss distance 5.79 LD. See: 413577 2005 UL5- SSA , 2005 UL5 - JPL See also: 22 Nov 2190 .
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2880, Mar 16	Apollo NEA 29075 (1950 DA = 2000 YK66) , $H = 17.5$ mag, $D \approx 1.39$ km 1.46 km 1.07 km, PHA) has a 1-in-8330 chance of impacting in 2880. See: 29075 1950 DA - SSA , 1950 DA - JPL Ref: - J.D. Giorgini, S.J. Ostro, L.A.M. Benner, et al., 2002, <i>Science</i> , 296, 132, "Asteroid 1950 DA 's encounter with Earth in 2880: physical limits of collision probability prediction." See: http://adsabs.harvard.edu/abs/2002Sci...296..132G - A.P.J. Abdul Kalam, President of India, 4 January 2003, Space Summit address to the 90 th Indian Science Congress, "Vision for the global space community: prosperous, happy and secure planet earth."

	See: http://neo.jpl.nasa.gov/1950da/1950DA_Kalam_90th_Indian_Congress.pdf - K. Wong, 2003, <i>Scientific American</i>, "2880 asteroid impact simulation suggests tsunamis could hammer Atlantic coast." See: http://www.scientificamerican.com/article.cfm?id=2880-asteroid-impact-simu - S.N. Ward, E. Asphaug, 2003, <i>Geophysical Journal International</i>, 153, F6, "Asteroid impact tsunami of 2880 March 16." See: http://adsabs.harvard.edu/abs/2003GeoJI.153F...6W - S.J. Ostro, J.D. Giorgini, 2004, in: M.J.S. Belton, et al. (eds.), <i>Mitigation of Hazardous Comets and Asteroids</i> (Cambridge: CUP), p. 54, "The role of radar in predicting and preventing asteroid and comet collisions with Earth." See: http://adsabs.harvard.edu/abs/2004mhca.conf...38O - M.W. Busch, J.D. Giorgini, S.J. Ostro, et al., 2007, <i>Icarus</i>, 190, 608, "Physical modeling of near-Earth asteroid (29075) 1950 DA." See: http://adsabs.harvard.edu/abs/2007Icar..190..608B - D. Farnocchia, S.R. Chesley, 2014, <i>Icarus</i>, 229, 321, "Assessment of the 2880 impact threat from asteroid (29075) 1950 DA." See: http://adsabs.harvard.edu/abs/2014Icar..229..321F See also: http://neo.jpl.nasa.gov/1950da/ https://cneos.jpl.nasa.gov/doc/1950da/ http://neo.jpl.nasa.gov/risk/a29075.html http://www.planetary.org/news/2002/0412_A_Close_Call_for_Earth_in_87_8_Years.html http://www.scientificamerican.com/article.cfm?id=asteroid-impact-possible http://neo.ssa.esa.int/ # January 2016. http://en.wikipedia.org/wiki/(29075)_1950_DA See also: 5 Mar 2001.

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EXTERNAL LINKS

American Meteor Society	http://www.amsmeteors.org/fireballs/
ANSMET	http://geology.cwru.edu/~ansmet/
Arcetri NEO Procovery Program	http://www.arcetri.astro.it/science/aneopp/
Asia-Pacific Asteroid Observation Network	http://www.spaceguard.or.jp/apao/index.html
Asiago DLR Asteroid Survey	http://dipastro.pd.astro.it/planets/adas/#team
Association of Space Explorers	http://www.space-explorers.org/committees/NEO/neo.html
Asteroid Day	http://www.asteroidday.org/
Asteroid Deflection Research Center	http://www.adrc.iastate.edu/
Asteroid and Comet Impact Hazards	http://impact.arc.nasa.gov/
Asteroid Impact & Deflection Assessment (AIDA)	http://www.esa.int/esaMI/NEO/SEMAWBTWT1H_0.html https://www.nasa.gov/planetarydefense/aida
Asteroid Impact Mission (AIM)	http://www.esa.int/Our_Activities/Space_Engineering_Technology/NEO/Asteroid_Impact_Mission_AIM

Asteroid Threat Assessment Project (ATAP)	https://www.lpi.usra.edu/sbag/meetings/jun2017/presentations/Mathias.pdf
Asteroid Watch	http://www.jpl.nasa.gov/asteroidwatch/
AsteroidWatch (on Twitter)	http://twitter.com/AsteroidWatch
Astrophysics Data System	http://www.adsabs.harvard.edu/
Asteroid Radar Research	http://echo.jpl.nasa.gov/
AsteroidFinder	http://www.dlr.de/pf/en/desktopdefault.aspx/tabid-174/319_read-18911/
ATLAS	http://www.fallingstar.com/index.php
B612 Foundation	http://www.b612foundation.org/
B612 Foundation Asteroid Institute	https://b612foundation.org/resource_subjects/asteroid-institute/
Cameras for Allsky Meteor Surveillance (CAMS)	http://cams.seti.org/
Catalina Sky Survey	http://www.lpl.arizona.edu/css/index.html
Chang'e-2	http://en.wikipedia.org/wiki/Chang'e_2
China NEO Survey (NEOST)	http://english.pmo.cas.cn/rh/dcm/nsb/200908/t20090831_35079.html
CINEOS	http://en.wikipedia.org/wiki/Campo Imperatore Near-Earth Object Survey
Daily Minor Planet	http://www.minorplanetcenter.net/daily-minor-planet
Discovery Channel Telescope	http://www.lowell.edu/dct/
DANEOPS	http://earn.dlr.de/daneops/
DARPA Space Surveillance Telescope (SST)	http://www.darpa.mil/program/space-surveillance-telescope
Desert Fireball Network (DFN)	http://www3.imperial.ac.uk/desertfireballnetwork
DESTINY+	https://en.wikipedia.org/wiki/DESTINY+
DLR Institute of Planetary Research	http://www.dlr.de/pf/en/
European Asteroid Research Node	http://earn.dlr.de/
EARN NEA Data Base	http://earn.dlr.de/nea/
Earth Impact Effects Program	http://impact.ese.ic.ac.uk/ImpactEffects/
Ephemerides of Minor Planets	http://www.ipa.nw.ru/PAGE/DEPFUND/LSBSS/engphem.htm
ESA Fly-eye telescope	http://www.esa.int/spaceinimages/Images/2016/10/Fly-eye_telescope
ESA Hera	http://www.esa.int/Our_Activities/Space_Engineering_Technology/Hera/Hera
ESA NEO Coordination Center	http://neo.ssa.esa.int/
ESA NEO Space Mission Studies	http://www.esa.int/Our_Activities/Technology/NEO
ESA Planetary Defence Office	http://www.esa.int/Enabling_Support/Operations/Planetary_Defence_Office_contact_details
ESA Space Situational Awareness	http://www.esa.int/ssa/neo
ESA Tenerife Observatory Teide Asteroid Survey (TOTAS)	https://totas.cosmos.esa.int/mover.php?id=220640
European Fireball Network	http://www.dlr.de/pf/desktopdefault.aspx/tabid-623
European Planetary Science Congress	http://www.europlanet-ri.eu/epsc
European NEA Search Observatories	http://earn.dlr.de/euneaso.htm
EURONEAR	http://euronear.imcce.fr/tiki-index.php?page=HomePage
Earth Impact Database	http://www.passc.net/EarthImpactDatabase/index.html
Hayabusa	http://www.isas.jaxa.jp/e/enterp/missions/hayabusa/index.shtml
Hayabusa-2	http://www.jspec.jaxa.jp/e/activity/hayabusa2.html
IAF NEOs Technical Committee	http://www.iafastro.com/index.html?title=Committee_on_Near_Earth_Objects
IAU Minor Planet Center	http://www.cfa.harvard.edu/iau/mpc.html
IAU Meteor Data Center	http://www.astro.amu.edu.pl/~jopek/MDC2007/
International Asteroid Warning Network (IAWN)	http://iawn.net
Impact Database	http://impacts.rajmon.cz/index.html
IMPACTON	http://www.on.br/impacton/
International Academy of Astronautics (IAA)	http://www.iaaweb.org/
International Asteroid Warning Network	http://www.minorplanetcenter.net/IAWN/ , http://iawn.net/
99942 Apophis 2021 Observing Campaign	http://iawn.net/obscomp/Apophis/
International Astronomical Union (IAU)	http://www.iau.org
International Meteor Organization (IMO)	http://www.imo.net/
International Primitive Body Exploration Working Group	http://ipewg.caltech.edu/

International Scientific Optical Network (ISON) <http://lfvn.astronomer.ru/report/0000029/index.htm>
 International Asteroid Warning Network (IAWN) <http://www.minorplanetcenter.net/IAWN/>
 Jet Propulsion Laboratory's Center for NEO Studies (CNEOS) <http://cneos.jpl.nasa.gov/>
 KLENOT http://www.klet.org/?stranka=klenot&menu_id=4&uroven=2
 La Sagra Sky Survey <http://lasagraskysurvey.org/>
 Large Synoptic Survey Telescope <http://www.lsst.org/lsst>
 LCOGT network <http://lcogt.net/>
 LINEAR <http://www.ll.mit.edu/mission/space/linear/>
 Lowell Discovery Telescope <https://lowell.edu/research/research-facilities/4-3-meter-ldt/>
 LPI http://www.lpi.usra.edu/publications/slidesets/craters/crater_index.shtml
Marco Polo-R <http://www.oca.eu/MarcoPolo-R/>
 Meteoritical Society <http://www.meteoriticalsociety.org/>
 MIT Project Apophis <https://eapsweb.mit.edu/mit-project-apophis>
 NASA All Sky Fireball Network <http://fireballs.ndc.nasa.gov/>
 NASA Asteroid Initiative and Grand Challenge <http://www.nasa.gov/asteroidinitiative>
 NASA Asteroid and Comet Hazard <http://impact.arc.nasa.gov/index.cfm>
 NASA Asteroid Watch <http://www.jpl.nasa.gov/asteroidwatch>
 NASA Asteroid and Comet Watch http://www.nasa.gov/mission_pages/asteroids/main/index.html
 NASA Asteroid Radar Research <http://echo.jpl.nasa.gov/>
 NASA Asteroid Redirect Mission <http://www.nasa.gov/content/what-is-nasa-s-asteroid-redirect-mission>
 NASA Meteoroid Environment Office <https://www.nasa.gov/arm>
 NASA Meteoroid Environment Office <http://www.nasa.gov/offices/meo/home/aboutMEO-rd.html>
 NASA Meteoroid Environment Office <http://www.nasa.gov/offices/meo/outreach/>
 NASA Near Earth Object Program <http://neo.jpl.nasa.gov/>
 NASA Planetary Data System <https://pds.nasa.gov/>
 NASA Planetary Data System Small Bodies Node <https://pds-smallbodies.astro.umd.edu/>
 NASA Planetary Defense Coordination Office (PDCO) <http://www.nasa.gov/planetarydefense>
 NASA Planetary Science, Asteroids <http://nssdc.gsfc.nasa.gov/planetary/planets/asteroidpage.html>
 NASA Solar System Exploration Research Virtual Institute (SERVI) <http://sservi.nasa.gov>
 Near-Earth object Lunar Impacts and Optical TrAnsients (NELIOTA) <http://neliota.astro.noa.gr/>
NEA Scout <https://www.nasa.gov/content/nea-scout>
NEOCam <http://neocam.ipac.caltech.edu/>
 NEODYs (University of Pisa) <http://newton.dm.unipi.it/neodys/>
 NELIOTA <https://neliota.astro.noa.gr/>
 NEOShield <http://www.neoshield.net/en/index.htm>
NEO Scout <https://www.nasa.gov/content/nea-scout>
NEOSSat <http://www.asc-csa.gc.ca/eng/satellites/neossat/>
 NEOStel <http://creotech.pl/project/neostel>
NEO-WISE <http://neo.jpl.nasa.gov/stats/wise/> <http://neowise.ipac.caltech.edu/>
https://www.nasa.gov/mission_pages/WISE/main/index.html
OSIRIS-Rex <http://osiris-rex.lpl.arizona.edu/>
 Near-Earth Object Human Space Flight Accessible Targets Study (NHATS) <http://neo.jpl.nasa.gov/nhats/>
 Pan-STARRS <http://pan-starrs.ifa.hawaii.edu/public/>
 Planetary Data System <http://pds.nasa.gov/>
 Planetary Defense <http://planetary.org/defense>
 Planetary Resources <http://www.planetaryresources.com/>
 Planetary Society <http://www.planetary.org/home/>
 Radar Astronomy <http://mel.ess.ucla.edu/radar/>
 Space Mission Planning Advisory Group (SMPAG) <http://www.cosmos.esa.int/web/smpag/home>
<http://smpag.net>
 Secure World Foundation <http://www.secureworldfoundation.org/>
Sentinel Space Telescope Mission <http://b612foundation.org/media/sentinelmission/>
 SENTRY (JPL) <http://neo.jpl.nasa.gov/risk/>
 Siding Spring Survey <http://www.mso.anu.edu.au/~rmn/>
 Slooh SpaceCamera <http://events.slooh.com/>

Small Bodies Assessment Group	http://www.lpi.usra.edu/sbag/
Small Solar System Objects Spectroscopic Survey (S ³ OS ²)	http://sbn.psi.edu/pds/resource/s3os2.html
Space Missions Planning Advisory Group	http://www.cosmos.esa.int/web/smpag
Solar System Object Search	http://www3.cadc-ccda.hia-ihp.nrc-cnrc.gc.ca/ssos/
Space Foundation	http://www.spacefoundation.org/
Space Generation Advisory Council	http://spacegeneration.org/
The Spaceguard Center	https://spaceguardcentre.com/
Spaceguard Foundation	http://spaceguard.iasf-roma.inaf.it/
Spaceguard Central Node	http://www.esa.int/esaMI/NEO/SEMS58OVGJE_0.html
Spaceguard Australia	http://users.tpg.com.au/users/tps-seti/spacegd.html
Spaceguard Croatia	http://www.astro.hr/spaceguard/
Spaceguard Japan	http://www.spaceguard.or.jp/ja/e_index.html
Spaceguard Spain	http://www.spaceguardspain.org/
Spaceguard United Kingdom	http://www.spaceguarduk.com/
Spacewatch	http://spacewatch.lpl.arizona.edu/
TOTAS	http://vmo.estec.esa.int/totas
UAO-DLR Asteroid Survey (UDAS)	http://earn.dlr.de/udas/
UN-COPUOS	http://www.oosa.unvienna.org/oosa/COPUOS/copuos.html
UN-COPUOS STSC	http://www.unoosa.org/oosa/en/ourwork/copuos/stsc/2019/index.html
UN Office for Outer Space Affairs	http://www.unoosa.org/
UN OOSA Near Earth Objects	http://www.unoosa.org/oosa/en/ourwork/topics/neos/index.html
Warm <i>Spitzer</i> NEO Survey	http://ssc.spitzer.caltech.edu/spitzermission/observingprograms/es/
WFIRST	https://wfirst.gsfc.nasa.gov/
	https://wfirst.gsfc.nasa.gov/about.html
	https://www.nasa.gov/wfirst

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