

## ESA's NEO Coordination Centre

### Current NEO statistics

As it had been anticipated already last month, 2019 has been a record-breaking year in NEA discoveries, with an increase of nearly 30% with respect to 2018.

- Known NEOs: 21 655 asteroids and 109 comets
- NEOs in risk list\*: 996
- Number of NEOs designated during last month: 226
- NEOs discovered since 1 January 2019: 2370

### Focus on

Fireballs are typically local events, only detectable from a radius of a few hundred kilometres around the impact point. Therefore, contrary to more distant astronomical events, proper records of events were uncommon until a couple of centuries ago. It is therefore surprising when detailed accounts are found in archival historical writings. This is what happened a few months ago, when documents emerged regarding a major daytime fireball that happened 340 years ago, on 24 January 1680, over Northern Italy, in what is today the Province of Brescia. The record is in the form of a few lines hand-written on a notebook by a parish priest from a small village. They contain a surprisingly accurate description of what he saw: "This morning around 13 hours a huge comet appeared in the sky, and fell towards Earth making the whole sky shine with fire, followed by a great noise as of a thunder that was felt throughout the whole province, and the fire and splendour similarly were seen throughout the entire territory".

The description seems to suggest a major event, but unfortunately no other records have been found so far. No associated meteorite falls are known either, although it is important to remember that the association between fireballs and meteorites was not known at the time, having been made by Ernst Chladni only more than a century later.

### Upcoming interesting close approaches

A large object will have a distant fly-by this month.

- 2019 UO, a 300-metre object, will have a fly-by at 12 lunar distances on 10 January.

### Recent interesting close approaches

Four known asteroids came closer than the Moon in December.

- 2019 YS, 2019 YU2, 2019 YB and 2019 YV4 are four small objects that flew by the Earth at less than 1 lunar distance during the second half of December. 2019 YU2 reached a maximum brightness of about magnitude 14.

### News from the risk list

One new object reached a significant Palermo Scale in December.

- 2019 YX1, a newly discovered 40-metre asteroid, reached an impact probability of 1 in 9 000 and a Palermo Scale of  $-4.3$  for an impact in 2081.

\* The risk list of all known objects with a non-zero (although usually very low) impact probability can be found at <http://neo.ssa.esa.int/risk-page>

## In other news

- OSIRIS-REx landing sites (primary and backup) for sample collection on asteroid Bennu have been selected. The sample collection event is scheduled for August 2020.
- The well-known Apophis hype occurred 15 years ago, when observations taken on December 2004 implied substantial impact probabilities with Earth in 2029. Luckily, the identification of precovery images and additional later observations allowed the removal of all impact chances for 2029 and the decrease of its cumulative Palermo Scale for following years to a current value of  $-3.6$ .

## Upcoming events

Relevant international meetings over the next months.

- Asteroids, Comets, Meteors Conference, 14–19 June 2020, Flagstaff, USA  
<https://www.hou.usra.edu/meetings/acm2020/>

## Highest rated objects added to the risk list in 2019

The table shows the top 10 objects entering the risk list in 2019 and which are still present, ranked by current Palermo Scale.

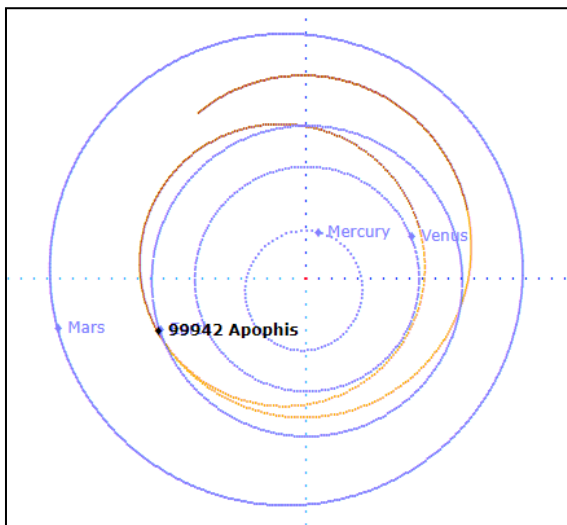
Object name	Size range in m	Date of possible impact	Impact probability	Palermo Scale	Torino Scale	Velocity in km/s
2019 DS1	20–50	2082-02-26 19:15	1 / 700	-3.32	0	15.32
2019 LW4	12–26	2083-06-08 18:50	1 / 900	-4.28	0	14.12
2019 YX1	40–80	2081-12-27 18:43	1 / 25 000	-4.33	0	13.86
2019 ND7	130–300	2097-07-20 05:18	1 / 80 000 000	-4.38	0	26.75
2019 LU1	40–90	2056-06-05 11:12	1 / 400 000	-4.61	0	33.70
2019 TU	16–40	2099-01-27 20:48	1 / 8 000	-4.69	0	14.81
2019 BE5	24–50	2044-01-29 21:20	1 / 130 000	-4.79	0	17.64
2019 QR3	10–22	2078-08-31 22:36	1 / 6 000	-4.92	0	15.67
2019 WG2	27–60	2114-11-24 08:12	1 / 60 000	-4.96	0	18.53
2019 WU2	30–70	2093-11-04 16:02	1 / 110 000	-5.05	0	16.06

## Links for more information

Website: <http://neo.ssa.esa.int>

Close approaches: <http://neo.ssa.esa.int/close-approaches>

Risk List: <http://neo.ssa.esa.int/risk-page>



As mentioned in the text above, the 2004 hype surrounding the possible impact of (99942) Apophis was quickly replaced with the knowledge that the asteroid will not impact the Earth in 2029. Instead, it will have an extremely close approach with our planet, at only 32 000 km from the surface on 13 April 2029.

The approach will be so close that the orbit of the asteroid will be dramatically modified by the effect of Earth's gravity, changing from an Aten-type orbit with a semimajor axis of 0.9 au to an Apollo-type orbit with a semimajor axis of 1.1 au.

The figure to the left shows the orbital changes around the time of its close approach with the Earth in 2029.

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