

## space situational awareness

### → NEAR-EARTH OBJECTS

#### Current NEO statistics

The number of known NEOs increased at a steady pace of more than 100 objects last month, with 10 more entries in the risk list.

- Known NEOs: 13 315 asteroids and 104 comets
- NEOs in risk list\*: 532
- New NEO discoveries since last month: 137
- NEOs discovered since 1 January 2015: 1360

#### Focus on

November was a month of close approaches of many small objects. A particularly interesting case was 2015 VY105, which came to less than 30 000 km from the Earth's surface on 15 November. It had been discovered only 20 hours earlier by the Catalina Sky Survey, and quickly confirmed by a few other observatories worldwide. It has an absolute magnitude of 29, corresponding to a diameter of 5 to 10 meters.

#### Upcoming interesting close approaches

A large object will have a close approach in mid-December.

- (33342) 1998 WT24 is a 400-meter object that will come to 11 lunar distances on 11 December, reaching magnitude 11.

#### Recent interesting close approaches

Four objects came closer than one lunar distance in November.

- 2015 VY105, 2015 VU64, 2015 WP2 and 2015 VP64 all came within a lunar distance in November, and were all smaller than 10 meters. All of them were discovered by the Catalina Sky Survey, which has been particularly successful in discovering these small objects.
- (413577) 2005 UL5 is a large 400-meter object that had a close fly-by on 20 November at 6 lunar distances.

#### News from the risk list

New radar observations of the high-rated object (410777) 2009 FD show that it is a binary, and much smaller than we thought.

- (410777) 2009 FD, the highest-rated possible impactor for the next two centuries, was observed by radar. It was discovered that the object is binary, and significantly smaller than previously thought. The effects of this additional information for the impact threat are still being assessed, therefore the impact ratings have been left unchanged for now, but will be updated soon.
- 2015 RN35 decreased its Palermo Scale to a more routine level of  $-4$ , and it is now out of the top-10 Risk List.
- 2015 WA2 was a new addition to the top-10 objects of the risk list in late November, for multiple impact possibilities starting from year 2030. It has now been entirely removed from the list thanks to additional observations.

\* The risk list of all known objects with a non-zero (although usually very low) impact probability can be found at <http://bit.ly/nea-risklist>

## In other news

- ESA participated in the airborne observation campaign for the re-entry of WT1190F. A video of the re-entry can be found at [https://www.youtube.com/watch?v=YJT-q8\\_dI88](https://www.youtube.com/watch?v=YJT-q8_dI88).

## Upcoming events

The next gathering of planetary defence scientists is upcoming, in San Francisco.

- Asteroids & Planetary Defense session at the AGU Fall Meeting, 14–18 December 2015, San Francisco, USA  
<https://agu.confex.com/agu/fm15/preliminaryview.cgi/Session7518>
- Planetary Defense session at the 2016 IEEE Aerospace Conference, 5–12 March 2016, Big Sky, USA  
<http://www.aeroconf.org/>
- IAA Planetary Defense Conference, 15–19 May 2017, Tokyo, Japan  
<http://pdc.iaaweb.org/>

## List of closest approaches in the past five years

Only nine known objects came within 5 Earth radii from the Earth's surface during the past 5 years.

At the top of the list is 2014 AA, the only known impactor during this time period.

It is interesting to observe that seven out of nine objects were discovered by the Catalina Sky Survey.

All the distances quoted in this table are referred to the Earth's surface, not to the geocentre.

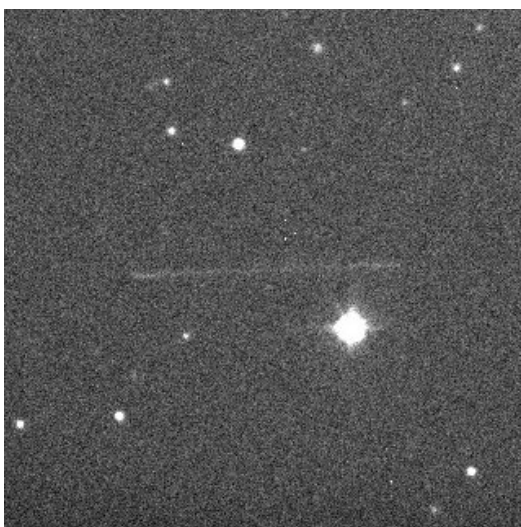
Object name	Close approach date	Miss distance in lunar distances	Miss distance in Earth radii	Miss distance in km	Size in m	H magnitude
2014 AA	2014-01-02	0	0	0	~ 3	30.9
2011 CQ1	2011-02-05	0.014	0.9	5 500	~ 2	32.1
2014 LY21	2014-06-04	0.030	1.8	~ 10 000	~ 6	29.1
2011 MD	2011-06-28	0.032	1.9	12 300	~ 10	28.0
2012 KT42	2012-05-29	0.038	2.3	14 400	~ 7	28.8
2015 SK7	2015-09-23	0.053	3.2	20 200	~ 8	28.7
2013 YB	2013-12-24	0.054	3.3	~ 21 000	~ 2	31.5
(367943) Duende	2013-02-16	0.072	4.3	27 700	30	24.0
2015 VY105	2015-11-15	0.074	4.4	28 300	~ 7	29.0

## Links for more information

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

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

Risk List: <http://neo.ssa.esa.int/web/guest/risk-page> or <http://bit.ly/neorisklist>



The long trail at the centre of this image is 2015 VY105, as seen from the Schiaparelli Observatory in Italy on 15 November 2015 at 00:34 UT, only a couple of hours before its closest approach to Earth.

At the time of this exposure the object was moving in the sky at an angular speed of 500"/min, so the entire trail corresponds to only 30 seconds of exposure time.

It is interesting to notice that the object is changing its brightness during the exposure, thus implying a rotation period of the order of minutes.

Image credit: L. Buzzi

[neo.ssa.esa.int](http://neo.ssa.esa.int)

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