→ NEWSLETTER APRIL 2021

ESA's NEO Coordination Centre

Current NEO statistics

Discovery average is almost 240 new objects per month since the start of the year.

- Known NEOs: 25 366 asteroids and 113 comets
- NEOs in risk list*: 1139
- Number of NEOs designated during last month: 171
- NEOs discovered since 1 January 2021: 711

Focus on

On 7 March 2021, for the first time ever, the occultation of a star caused by (99942) Apophis was observed.
Successfully detecting an occultation event is always a challenge, but it becomes much harder when the occulting body is a small NEO, only ~350 metres in diameter. This is because the ground track of the event is only as wide as the asteroid itself, and therefore the exact location of the event must be predicted to that level of accuracy. In order to achieve this precision two main ingredients come into play: our knowledge of the asteroid's trajectory, and of the position of the occulted star. The 7 March event luckily had both. The occulting asteroid was Apophis, one of the best-characterised NEOs due to the significant impact potential. The target star was a bright magnitude 8 star, well observed by ESA's Gaia mission, and therefore its position was known with exquisite accuracy. Adding to this promising picture, Apophis had been successfully observed by radar just a few days earlier, further refining its trajectory. And the effort paid off: three observers were able to witness the disappearance of the target star, for about 0.2 s, caused by Apophis moving in front of it. These detections could in turn be converted into astrometric measurements that are good to better than a milliarcsecond, a precision that is not reachable from the ground with any other technique. It is an exceptional success, which paves the way for a broader use of occultations in the study of the dynamics of NEOs. And it was ESA's Gaia mission, with its unrivalled astrometric accuracy, that made it all possible.

Upcoming interesting close approaches

No object known at the beginning of the month is expected to come closer than the Moon during the month of April.

Recent interesting close approaches

A large known object flew by in March and was well observed thanks to its brightness.

- (231937) 2001 FO32, a well-known km-sized NEO, flew-by at about 2 million kilometres from the Earth on 21 March, reaching magnitude 11.

News from the risk list

A new object appeared near the top of the list, while another went down significantly.

- 2021 EU is a new entry in our risk list, a ~30-metre object with a cumulative impact probability of 1 in 40 000 over the next century.
- 2021 DG1, mentioned last month, left the list thanks to new observations.

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

In other news

- Thanks to radar observations obtained of Apophis at the beginning of March, it has been possible to remove all the remaining possible impactors in the next years. For more information, check this news item.
- Asteroid Day has announced their 2021 virtual event activities beginning 1 June and running through 4 July. This year's theme is 25 Years of Dedicated Asteroid Missions in light of the NEAR-Shoemaker launch anniversary. Visit asteroidday.org to learn more.

Upcoming events

Relevant international meetings over the next months.

- 7th IAA Planetary Defense Conference, 26–30 April 2021, virtual
  https://iaaspace.org/event/7th–iaa–planetary–defense–conference–2021/

Time evolution of close approach circumstances of Apophis

The table summarises how our knowledge of the Apophis fly-by on 2029 April 13 evolved with time.

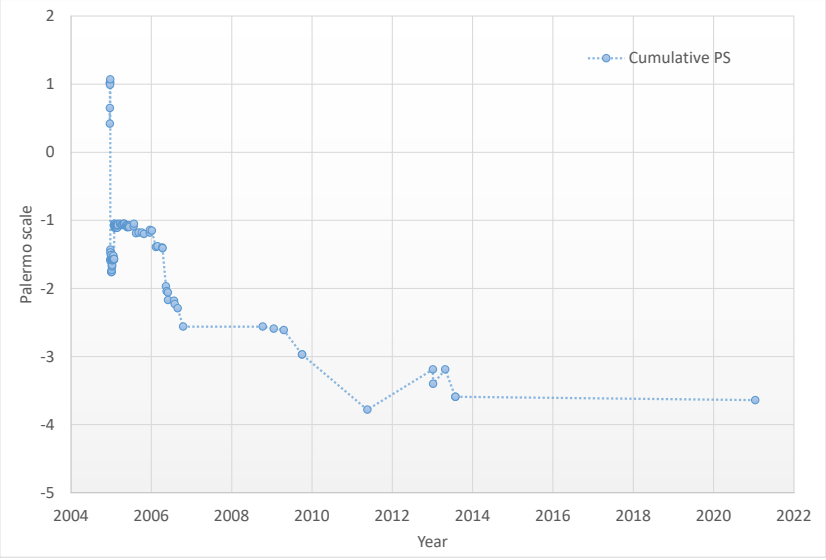
Each line presents the fly-by circumstances and their uncertainties computed on the basis of increasingly extended observational arcs. The arcs are split by oppositions, defined as intervals over which Apophis remained at a solar elongation greater than 30°.

Observational arc		Number of optical observations	Number of radar observations	Close approach time in TDT	Close approach time uncertainty in s	Close approach distance to Earth centre in km	Close approach dist. uncertainty in km
2004-03-15	2005-08-07	958	6	21:45:59	9	37 000	500
2004-03-15	2007-03-09	1384	7	21:46:13	9	37 900	500
2004-03-15	2008-01-09	1409	7	21:46:13	9	38 000	500
2004-03-15	2012-05-08	1548	7	21:46:16	8	38 100	400
2004-03-15	2013-05-27	4456	46	21:46:16	5	38 210	290
2004-03-15	2015-01-03	4469	46	21:46:16	5	38 200	290
2004-03-15	2020-06-08	4523	46	21:46:17	4	38 220	220
2004-03-15	2021-03-31	7532	50	21:46:12.58	0.03	38 012.6	1.6

N.B.: TDT (Terrestrial Dynamical Time) is a timescale that is currently roughly 70 seconds ahead of UTC. The exact offset between the two timescales depends on how many leap seconds are added. Since it is related to the future rotational speed of the Earth, the precise UTC time cannot be exactly predicted in advance.

Links for more information

Website: https://neo.ssa.esa.int
Close Approaches List: https://neo.ssa.esa.int/close-approaches
Risk List: https://neo.ssa.esa.int/risk-list



Evolution along the years of the cumulative Palermo Scale (PS) for Apophis from the time of discovery until the moment it was removed from the risk list.

The cumulative PS blends into one value the threat posed by all the detected virtual impactors for a given asteroid.

[Credit: ESA/NEOCC]

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