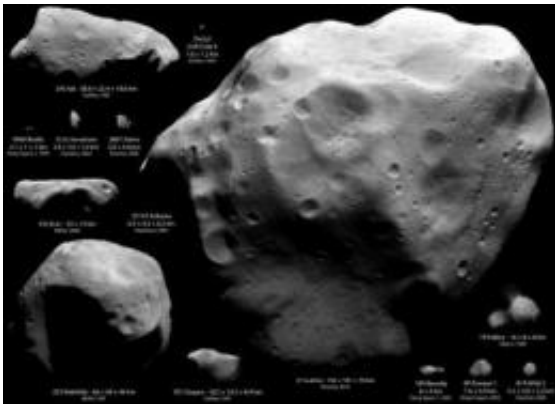


Potentially hazardous asteroid might collide with the Earth in 2182

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These are asteroids and comets visited by spacecraft. Credit: ESA, NASA, JAXA, RAS, JHUAPL, UMD, OSIRIS

The potentially hazardous asteroid, (101955) 1999 RQ36, has a one-in-a-thousand chance of impacting the Earth, and more than half of this probability indicates that this could happen in the year 2182, based on a global study in which Spanish researchers have been involved. Knowing this fact may help design in advance mechanisms aimed at deviating the asteroid's path.

"The total impact probability of asteroid '(101955) 1999 RQ36' can be estimated in 0.00092 -approximately one-in-a-thousand chance-, but what is most surprising is that over half of this chance (0.00054) corresponds to 2182," explains to SINC María Eugenia Sansaturio, co-

author of the study and researcher of Universidad de Valladolid (UVA). The research also involved scientists from the University of Pisa (Italy), the Jet Propulsion Laboratory (USA) and INAF-IASF-Rome (Italy).

Scientists have estimated and monitored the potential impacts for this asteroid through 2200 by means of two mathematical models (Monte Carlo Method and line of variations sampling). Thus, the so called Virtual Impactors (VIs) have been searched. VIs are sets of statistical uncertainty leading to collisions with the [Earth](#) on different dates of the XXII century. Two VIs appear in 2182 with more than half the chance of impact.

Asteroid '(101955) 1999 RQ36' is part of the Potentially Hazardous Asteroids (PHA), which have the possibility of hitting the Earth due to the closeness of their orbits, and they may cause damages. This PHA was discovered in 1999 and has around 560 meters in diameter.

The Yarkovsky effect

In practice, its orbit is well determined thanks to 290 optical observations and 13 radar measurements, but there is a significant "orbital uncertainty" because, besides gravity, its path is influenced by the Yarkovsky effect. Such disturbance slightly modifies the orbits of the Solar System's small objects because, when rotating, they radiate from one side the radiation they take from the sun through the other side.

The research, which has been published in *Icarus* journal, predicts what could happen in the upcoming years considering this effect. Up to 2060, divergence of the impacting orbits is moderate; between 2060 and 2080 it increases 4 orders of magnitude because the [asteroid](#) will approach the Earth in those years; then, it increases again on a slight basis until another approach in 2162, it then decreases, and 2182 is the most likely

year for the collision.

"The consequence of this complex dynamic is not just the likelihood of a comparatively large impact, but also that a realistic deflection procedure (path deviation) could only be made before the impact in 2080, and more easily, before 2060," stands out Sansaturio.

The scientist concludes: "If this object had been discovered after 2080, the deflection would require a technology that is not currently available. Therefore, this example suggests that impact monitoring, which up to date does not cover more than 80 or 100 years, may need to encompass more than one century. Thus, the efforts to deviate this type of objects could be conducted with moderate resources, from a technological and financial point of view."

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