

# Reconstruction of the shape and spin-state model of potentially hazardous asteroid Apophis

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## Abstract

Asteroid (99942) Apophis is a near-Earth and potentially hazardous asteroid in an excited rotation state. It will closely approach Earth in April 2029 at the minimum geocentric distance of 38,000 km. During this approach, the tumbling spin state of Apophis is expected to be altered by Earth's gravitation torque. The exact change depends on the orientation of Apophis during the close approach. Although the shape and spin-state model of Apophis was reconstructed from 2012/13 light curve observations by Pravec et al. (2014, *Icarus* 233, 48), the rotation parameters' precision was insufficient to predict the orientation for 2029.

We will present our analysis of new photometric observations of Apophis. By applying the light curve inversion technique of Kaasalainen (2001, *A&A* 376, 302), we reconstructed Apophis's spin state and shape. We aimed to invert both 2012/13 and 2020/21 data sets and reconstruct the spin state with high precision. The long interval of observations would enable us to precisely determine the rotation and precession periods and thus reliably predict the orientation of Apophis during its 2029 fly-by, compute the change of its spin state, and predict how the non-gravitational Yarkovsky effect will influence its post-encounter orbit, which is crucial for reliably compute the post-2029 impact probabilities.