

Rotational Dynamics and Surface Environment of the Tumbling NEA (99942) Apophis

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In this work, we investigate the rotational dynamics and surface environment of the tumbling near-Earth asteroid (99942) Apophis, which is a candidate target for the Chinese asteroid mission. Combined with the previously published observation data, we use the photometric observations obtained by the Lijiang 2.4m telescope to study the spin states and rotational parameters of the asteroid. Effects of both gravitational and non-gravitational torques on the evolution of its rotation during the next two decades are evaluated, particularly for the two flybys in 2029 and 2036. Furthermore, dynamical features on surface of Apophis are sketched based on the shape model derived from ground observations. Assuming a homogenous density distribution, parameters such as geopotential, surface tilt and slope and some other characteristics are studied. Our investigation provides a better understanding on the status of the both rotational dynamics and near-surface dynamical status of Apophis.