

Dynamical particles around the asteroid 99942 Apophis

Raf Machado¹[0000000268750508], Othon Winter¹[0000000249013289], Giuliva Valvano¹[0000000279051788], Rafael Sfair^{1,2}[000000024939013X], Gabriel Borderes-Motta^{3,4}[0000000246808414], and Tamires Moura¹[0000-0002-3991-8738]

- ¹ São Paulo State University “Júlio de Mesquita Filho”, Grupo de Dinâmica Orbital e Planetologia, Guaratinguetá - Brazil
² Institut für Astronomie und Astrophysik, Eberhard Karls Universität Tübingen, Tübingen - Germany
³ Bioengineering and Aerospace Engineering Department, Universidad Carlos III de Madrid, Leganés, 28911, Madrid - Spain
⁴ Swedish Institute of Space Physics (IRF), 98128 Kiruna - Sweden

Abstract. 99942 Apophis is an asteroid belonging to the group of the Near Earth Asteroids (NEAs). His close encounter with Earth in 2029 can provide knowledge about this kind of objects, for that reason this body have a significant importance to astronomy. This study has the objective to analyze in depth the results present in Valvano et al. (2022)[1], investigating the dynamical characteristics of particles around the asteroid. To represent the body, it was considered a polyhedral model with diameter equivalent of 340 m and a density of 1,29 g/cm³ to build a representation with mass concentration (mascon). The system was build considering only the gravitational potential of the body and the centrifugal force associated with a rotation period of 27.38 ± 0.07 hours. Also, was considered initially the particles with keplerian orbits of both eccentricity and inclination being null, distributed in radial interval of 0.3 km to 1.0 km around the object. Through these conditions were numerically found resonant regions which are directly influenced by the asteroid shape model. Thus, was possible to point how the elongated format of Apophis implies in the dynamics of its neighborhood, influencing in the formation of stable regions and also in the location of the resonant regions.

Keywords: asteroids · irregular bodies · mascons · resonances.

References

1. Valvano, G., Winter, O., Machado Oliveira, R., Borgeres-Motta, G., Moura, T.: APOPHIS – effects of the 2029 Earth’s encounter on the surface and nearby dynamics. *Monthly Notices of the Royal Astronomical Society*.95–109 (2021)