Highlights of Spanish Astrophysics VI, Proceedings of the IX Scientific Meeting of the Spanish Astronomical Society held on September 13 - 17, 2010, in Madrid, Spain. M. R. Zapatero Osorio et al. (eds.)

Density of big boulders in pseudostable orbits around cometary nuclei

F. J. Jiménez-Fernández[1], A. Molina[1,2], and F. Moreno[1]

[1] Instituto de Astrofísica de Andalucía, Glorieta de la Astronomía s/n, 18008 Granada, Spain
[2] Dpto. Física Aplicada, Facultad de Ciencias, Avda. Fuente Nueva s/n, 18071 Granada, Spain

Abstract

We study the ejection of large dust grains from the surface of cometary nuclei and their possible injection into pseudo-stable orbits (see Molina et al. 2008, EMP, 102, 521). The equation of motion is numerically integrated. Together with the gravitational, the gas drag, and the radiation pressure forces, the inertial forces are also included. Particularly, the centrifugal force due to the spin of the comet is taken into account. The initial parameters to be considered are the ratio of the radiation pressure to the sun gravitational force β, the latitude ϕ, and the nucleus obliquity I. An application to two comets, with distinct physical and orbital characteristics, such as comet 1P/Halley and 46P/Wirtanen, is made. Flying times $t_{\rm v}$ are obtained and the orbital stability is discussed. A comparison between the results obtained from our rotational model and those from a co-rotational model is made (see Fulle 1997, A&A, 325, 1237). Large particles show higher $t_{\rm v}$ than small particles, which is shown to vary with nucleus obliquity. For a flying time equal to the orbital period, we found that the total mass injected into bound orbits for comet 46P/Wirtanen is about 1–2 % of the total mass ejected, for the co-rotational model. For the rotational model, this percentage becomes zero if the comet is set at zero obliquity, and increases up to 0.01–0.02 % when $I = 20°$. For comet 1P/Halley, these percentages are found to be near 0.1 % for the co-rotational model, increasing up to 0.4–2.4 % for the rotational model.