IAF ASTRODYNAMICS SYMPOSIUM (C1)
Orbital Dynamics (2) (4)

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PSYCHE MISSION: DYNAMICS ON AND NEARBY THE TARGET

Abstract

Radar observations show that (16) Psyche is one of the largest and most massive asteroids of the M-class located in the main belt, with a diameter of approximately 230 km. This fact makes Psyche a unique object, since observations indicated an iron-nickel composition. It is believed that this body may be what was left of a metal core of an early planet that would have been fragmented over millions of years due to violent collisions. In order to understand a little more of this enigmatic object, NASA has programmed the Psyche Space Mission, scheduled to launch in 2022, aiming to study the origin of planetary nuclei based on the exploration of (16) Psyche. In this work we study a variety of dynamical aspects related to the surface, as well as, the environment around this asteroid. First we reconstruct the (16) Psyche shape, determined by radar observations, given by a polyhedron of triangular faces. We use computational tools to explore the gravitational field generated by this body, assuming constant values for its density and rotation period. We then determine a set of physical and dynamical characteristics over its entire surface. The results include the geometric altitude, geopotencial altitude, tilt, slope, among others. We also explore the neighborhood around the asteroid (16) Psyche, so that the location and linear stability of the equilibrium points were found. We compute four external (two of them linearly stable) and one internal equilibrium points. We confirmed the stability of these points by performing numerical simulations of massless particles around the asteroid, which also showed an asymmetry in the size of the stable regions. In addition, we integrate a certain number of particles in the vicinity of (16) Psyche in order to verify in which regions of its surface the particles are most likely to collide.