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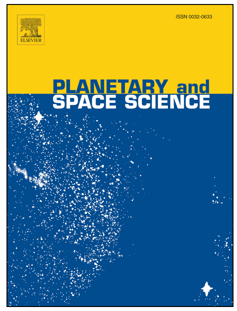

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THE SPIN-BARRIER FOR S AND C-TYPE MAIN ASTEROIDS BELT

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Abstract

Asteroids of size larger than 0.15 km generally do not have periods P smaller than about 2.2 hours, a limit known as cohesionless spin-barrier. This barrier can be explained by means of the cohesionless rubble-pile structure model. In this paper we will explore the possibility for the observed spin-barrier value to be different for C and S-type Main Asteroids Belt (MBAs), and we also intend look at the spin-barrier trend according to the asteroids diameter. On the basis of the actual bulk density values, the expected ratio between the maximum rotation periods is $P_C/P_S \approx 1.4 \pm 0.3$. Using the data available in the Asteroid LightCurve Data Base (ALCDB) we have found that, as regards the spin-barrier values and for asteroids in the 4-20 km range, there is really a difference between the two asteroids population with $P_C/P_S \approx 1.3 \pm 0.5$. Uncertainties are still high, mainly because of the small number of MBAs with known taxonomic class in the considered range. In the 4-10 km range, instead, the ratio between the spin-barriers seems closer to 1 because $P_C/P_S \approx 1.1 \pm 0.2$. This behavior could be a direct consequence of a different cohesion strength for C and S-type asteroids of which the ratio can be estimated.

Keywords: asteroids, spin-barrier, asteroids rotation

Introduction

Asteroids in the Main Belt (located roughly between the orbits of Mars and Jupiter), were subject to strong collisional interaction and the population that we see today is the result of billions of years of evolution. Pravec and Harris (2000), in their classical analysis on rotation periods, have argued that objects with size larger than about 0.15 km do not have periods smaller than about 2.2 hours (cohesionless spin-barrier), see Fig. 1. This spin barrier can be explained by means of a cohesionless "rubble-pile" structure model, in which asteroids with diameter greater than or equal to about 0.15 km are made up of collisional breakup fragments bound together by mutual gravitational force only. The asteroids with smaller diameters are considered instead as monolithic blocks, i.e. collisional fragments rotating faster than the spin-barrier value because of the strong internal solid-state forces that hold the body together. Rotation with periods exceeding this critical value will cause asteroid breakup and the formation of a binary system (Pravec and Harris, 2007).