

The Centrifugal Shedding of Regolith by Rigid Spinning Asteroids

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Light that is reflected or thermally emitted by an appropriately asymmetric asteroid exerts a torque that can increase or decrease the magnitude of the asteroid's spin angular momentum, and can also change the orientation of the asteroid's spin axis (the obliquity of its spin vector to its orbital angular momentum vector). This radiative torque seems to be most important for asteroids having diameters between a fraction of a kilometer and a few tens of kilometers, and is known as the Yarkovsky-O'Keefe-Radzievskii-Paddack (YORP) torque. A spun-up asteroid could shed some of its regolith. The spun-off regolith would then add to the collision-produced population of meteoroids orbiting the Sun. The orbits of the spun-off particles would be subject to strongly size-dependent radiative forces, in addition to gravitational forces. Unlike the meteoroids produced by collisions, and also unlike the meteoroids produced by a comet's dust stream, the centrifugal release of meteoroids by a spun-up asteroid would occur all along each of a large number orbits of the spinning asteroid. Although these phenomena would occur for both rubble-pile asteroids and for rigid asteroids, the present work considers only the rigid asteroids, which are far simpler to analyze. The rate at which a spinning rigid asteroid sheds regolith is estimated for asteroids having simple shapes, as a function of the asteroid's spin angular velocity.

Refs:

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