

Thermal Radiation Pressure Force on Regolith Particles of Atmosphereless Bodies

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It is suggested that thermal fracture near the perihelion is a possible mechanism to produce the dust trail of the near-Earth asteroid, (3200) Phaethon (Jewitt and Li, 2013, ApJ 771, L36). For this scenario to be true, generated dust particles should have been ejected from the surface before its next apparition to show the detectable activities (Li and Jewitt, 2013, ApJ, 145, 154). It is, however, not well understood how these particles were escalated from the regolith against the asteroid's gravity. In this study, we hypothesize that the thermal radiation pressure around the perihelion passage would exert substantial force on dust grains to be lifted up and contributes the dust tail formation with further help of solar radiation pressure. As a result, we find that roughly ~1-10 micron size dust grains can be ejected from Phaethon by the mechanism, while a detailed model of gravitational field is required for accurate range of the particle sizes. Our idea is not necessarily limited to Phaethon case, but is applicable to any atmosphereless bodies. We will explain how the thermal radiation pressure is effective at different distances from the sun.

Keywords: asteroids, regolith, thermal radiation