Dust Dynamics in the Rings of Chariklo

Juliet Pilewskie[1,2] and Mihaly Horanyi[1,2]

[1]*LASP, University of Colorado, Boulder, CO 80303*
[2]*Department of Physics, University of Colorado, Boulder, CO 80309*
juliet.pilewskie@colorado.edu

Abstract

Three years ago, the centaur Chariklo was discovered to have two rings[1], which made it the first known minor planet to have a ring system. The uniqueness of this situation calls for an examination as to how a two-ring system can be sustained around a small interplanetary object. We simulate, in 2D and 3D, a two-body system with solar radiation pressure perturbing a dust particle's orbit around a Chariklo-sized object. The lifetime of an orbiting dust particle is estimated by integrating its orbit as a function of its size and initial position. Our results show that for a water-ice or silicate particle with radius of 100 μm, its simulated orbit lasts for only about 20 years. This short lifetime suggests that there may be additional forces keeping the ring particle in place, and/or the presence of active sources of these particles. We also found that the dust particle's simulated orbital lifetime is longest when it is positioned where Chariklo's rings are located, which agrees with the observations already made of Chariklo's ring system. This research is the first step in better understanding the formation and sustainability of non-planetary ring systems.

[1] Braga-Ribas, F., et al. (2014), A ring system detected around the centaur (10199) chariklo, Nature, 508, 72-75, doi:10.1038/nature13155.