Asteroid Ring Formation Through 3-Dimensional Inelastic Collisions

Lee, Justin (School: Adlai E. Stevenson High School)

The asteroid 10199 Chariklo is the smallest body in the solar system observed to have a ring system. This research examines the origin of the ring systems around the asteroid 10199 Chariklo and the different mechanisms of the asteroid's ring formation by testing and analyzing the results of five hypotheses. The formation of ring systems and understanding the origin and stability of Chariklo's rings play a key role in astronomers' understanding of the dynamics of the early stages of the solar system and even galaxies. The first hypothesis conjectured that particles outside the orbit of Chariklo could drift into its gravitational field and conform to circular orbit. The second hypothesis reasoned that if Chariklo had experienced an impact, particles on its surface could be ejected into orbit. However, neither mechanism resulted in a circular ring. The third hypothesis assumed that Chariklo underwent two sequential impacts and was successful in explaining the possibility of forming a satellite but not a ring. The fourth hypothesis stated that equatorial particles being ejected into orbit would inelastically collide and create the tangential velocities needed to achieve circular orbit and was successful in forming a circular ring. Ultimately, the fifth hypothesis, as a generalization of the fourth hypothesis, considered not only particles originating from the equator of the asteroid but also from any location on its surface. It was found that the formation of a ring the same size as the one observed through occultation was feasible according to this hypothesis.

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