Hubble Space Telescope

Cycle 15 AR Proposal

Orbital Evolution and Chaos Among the Inner Moons of Uranus

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Abstract

Uranus has a family of thirteen satellites orbiting interior to the innermost classical moon, Miranda. Nine of these comprise the Portia group, a closely-packed dynamical system that has recently been found to show significant orbital variations over time scales of 1-2 decades. This result supports inferences that the system is chaotic, with collisions expected over time scales of less than one million years. No analogous orbital system has been seen elsewhere in the Solar System. With these new results, it becomes much more important to understand the orbital history of the inner moons of Uranus. The HST archive contains numerous detections of these moons, from WFPC2, NICMOS and ACS, that have never been used for orbital determinations. Many observations fill a gap between 1994 and 2003, during which the orbits have never been measured. This is a proposal to use all the available data from the HST archive to derive the orbital variations of the larger moons in the Portia group from 1994 to 2005. This investigation will provide unique new information about the time scales over which the variations occur and the nature of the hypothesized chaos. For example, this study will enable us to test the prediction that the two adjacent moons Cressida and Desdemona have closely coupled variations, and it may reveal whether the surprisingly large orbital deviations of Belinda are related to its resonance with the nearby, but much smaller moon Perdita.

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