

The Chaotic Dynamics of Prometheus and Pandora

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The longitudes of the F-ring shepherd satellites Prometheus and Pandora measured in recent HST images are different from predictions based on Voyager images. The discrepancies are of order 20 degrees. In a paper submitted to *Icarus* (Goldreich, P., and N. Rappaport 2002: Chaotic Motions of F-Ring Shepherds), we showed that these discrepancies are fully accounted for by the gravitational interactions between these satellites. These peak every 24.8 days at conjunctions and excite chaotic perturbations. Interactions are strongest when the orbits come close together. This happens at intervals of 6.2 years when the apses are anti-aligned. We found that the sudden changes of opposite changes in the mean motions of Prometheus and Pandora at the end of 2000 occurred shortly after their apsidal line was anti-aligned. The Lyapunov exponent for the Prometheus-Pandora system is of order 0.35 year^{-1} for satellite masses based on a nominal density of 1.3 g/cm^3 . In this presentation we will characterize the chaos as a function of the parameters and discuss new results pertaining to the understanding of the mechanism giving rise to it.

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