Vertical scattering of ring particles by inclined moonlets

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Abstract

Images of Saturn's rings, taken by the Cassini space-craft near Saturn's equinox in 2009, show shadows casted by structures in the rings. Examples are the ring moon Daphnis which perturbs the edges of the Keeler gap, but also propellers induced by embedded moonlets like Blériot.

Embedded moonlets on inclined orbits can affect the vertical structure of nearby ring material. Daphnis' inclination for example is proposed to induce vertical undulations of the Keeler gap edge [1].

We systematically investigate vertical structures due to gravitational scattering of ring particles by moonlets based upon the scattering operator concept [2]. As a measure of the ring thickness after scattering we calculate the root mean square of the vertical ring particle position for variing moonlet inclinations and eccentricites. Further we determine the optical depth of the structural elevations to estimate their height at the time around equinox and thus the contribution of the scattering process.

We compare our results with measured vertical heights of propellers induced by embedded moonlets like Blériot and Earhart [3] and with measured vertical heights of the Keeler gap edges [1].

References

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