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The vertical structure of the Daphnis wakes

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Abstract

When Saturn approached its equinox in August 2009 the Sun cast long shadows onto the ring-plane. Many shadows are caused by local vertical perturbations of the otherwise thin disk. The shadows at the Keeler gap edge are, for example, caused by Daphnis' gravitational perturbations. It has been proposed that these large vertical structures (more than 1 km) are caused by the inclination of Daphnis' orbit [1].

Here we show the possibility that also the ring-moon Daphnis on a non-inclined orbit is able to produce these vertical structures. We performed N-body particle simulations and found that particle collisions in the wake crests can significantly increase the vertical dispersion velocity and therefore the height of the corresponding structures. In the case of the Keeler gap edges this can lead to vertical excursions of the ring particles larger than 1 km. We compare and discuss the importance of both processes (moon inclination and particle collisions) for the vertical structure of the Keeler gap edges.

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