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Satellites migration in Saturn rings

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Abstract

The rings of Saturn are well-known for being shaped by resonant interactions with the satellites of Saturn orbiting outside the rings, such as Mimas or Janus. However, the rings also host satellites who orbit within them. For instance, Pan, visually detected by [1] orbits in the middle of the Encke division, and is responsible for the opening of this gap. More recently, small structures have been interpreted as the signature of about 100m bodies in the rings [2]. Similarly as for planets in protoplanetary discs, the action of the rings on these bodies should lead to their radial migration.

Bodies opening an empty gap (like Pan, or also Daphnis), should follow the rings viscous spreading in what is called the type II migration regime [3]. Therefore, we show that their presence and their position provides constraints on the evolution scenarios of Saturn rings.

In contrast, small bodies who do not open gaps, should drift with respect to the disc, in the so-called type I or type III [4] regime. We discuss how the standard theory of planetary migration applies in the rings, and we provide an estimate of the expected migration rate due to the action of the rings.

References

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