PARTICLE CLUSTERING IN PERIODICALLY FORCED PLANETARY RINGS.
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Cassini UVIS data show variable clumping on the edges of Saturn's rings, including the outer edges of the A and B rings, where they are strongly perturbed by satellites. A model to explain the perturbation was proposed in [1] for a classic "predator-prey" scenario where there is interplay between mass aggregations and mean velocity, but it remains to be seen whether dynamical *N*-body simulations show the same effect. We are working to quantify how resonant forcing modifies both the degree of particle clustering and the ring viscosity on orbital timescales.

This work was based on the REBOUND *N*-body code under open-source licensing [2]. We used the shearing boundary conditions and symplectic epicycle integrator (SEI) modules. Every 1/40th of an orbit, the position and velocity vector of every particle, and a screenshot were saved. Additionally, the viscosity of the cell was calculated per the method of [3].

Our forcing method only simulates radial forcing, neglecting the azimuthal variation of the satellite's gravitational potential and approximating the radial variation with a periodic function. Our implementation of the forcing function is to add another acceleration term to the SEI:

$$q \sin\left(\delta \cdot t.\mathrm{d}\right) \sin\left(2\pi x / L_x\right),$$

where q is the magnitude of the forcing, δ is a "detuning" parameter such that the forcing is not at the natural resonance, t.d is the decimal portion of the orbit ($0 \leq t.\mathrm{d} < 1$), and L_x is the radial size of the cell.

We will present our results-in-progress showing the effect of this forcing on the rings' properties, which demonstrate behavior similar to simulations of the perturbed edge of the Encke Gap [4].

References:
[1] Esposito *et al*. (2012) doi:10.1016/j.icarus.2011.09.029.
[2] Rein & Liu (2012) doi:10.1051/0004-6361/201118085.
[3] Daisaka *et al*. (2001) doi: 10.1006/icar.2001.6716.
[4] Lewis & Stewart (2005) doi:10.1016/j.icarus.2005.04.009.