



Predator-Prey model for haloes in Saturn's A ring

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UVIS SOI reflectance spectra show bright 'haloes' around the locations of some of the strongest resonances in Saturn's A ring (Esposito et al 2005). UV spectra constrain the size and composition of the icy ring particles (Bradley et al 2010, 2012). The correspondence of IR, UV spectroscopy, HSP wavelet analysis indicate that we detect the same phenomenon. We investigate the Janus 2:1, 4:3, 5:3, 6:5 and Mimas 5:3 inner Lindblad resonances as well as at the Mimas 5:3 vertical resonance (bending wave location). Models of ring particle regolith evolution (Elliott and Esposito 2010) indicate the deeper regolith is made of older and purer ice. The strong resonances can cause streamline crowding (Lewis and Stewart 2005) which damps the interparticle velocity, allowing temporary clumps to grow, which in turn increase the velocity, eroding the clumps and releasing smaller particles and regolith (see the predator-prey model of Esposito et al 2012). This cyclic behavior, driven by the resonant perturbation from the moon, can yield collision velocities at particular azimuths greater than 1m/sec, sufficient to erode the aggregates (Blum 2006), exposing older, purer materials: In the perturbed region, collisions erode the regolith, removing smaller particles. The released regolith material settles in the less perturbed neighboring regions. Diffusion spreads these ring particles with smaller regolith into a 'halo'. Thus, the radial location of the strongest resonances can be where we find both large aggregates and disrupted fragments, in a balance maintained by the periodic moon forcing. If this stirring exposes older, and purer ice, the velocity threshold for eroding the aggregates can explain why only the strongest Lindblad resonances show haloes. Diffusion can explain the morphology of these haloes, although they are not well-resolved spatially by UVIS.