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TITLE: F Ring Core Stability: Corotation Resonance Plus Antiresonance

**ABSTRACT BODY:**

**Abstract (2,250 Maximum Characters):** The decades-or-longer stability of the narrow F Ring core in a sea of orbital chaos appears to be due to an unusual combination of traditional corotation resonance and a novel kind of "antiresonance". At a series of specific locations in the F Ring region, apse precession between synodic encounters with Prometheus allows semimajor axis perturbations to promptly cancel before significant orbital period changes can occur (Cuzzi et al. 2014, Icarus 232, 157-175). This cancellation fails for particles that encounter Prometheus when it is near its apoapse, especially during periods of antialignment of its apse with that of the F Ring. At these times, the strength of the semimajor axis perturbation is large (tens of km) and highly nonsinusoidal in encounter longitude, making it impossible to cancel promptly on a subsequent encounter and leading to chaotic orbital diffusion. Only particles that consistently encounter Prometheus away from its apoapse can use antiresonance to maintain stable orbits, implying that the true mean motion  $n_F$  of the stable core must be defined by a corotational resonance of the form  $n_F = n_P - \kappa P/m$ , where ( $n_P$ ,  $\kappa P$ ) are Prometheus' mean motion and epicycle frequency. To test this hypothesis we used the fact that Cassini RSS occultations only sporadically detect a "massive" F Ring core, composed of several-cm-and-larger particles. We regressed the inertial longitudes of 24 Cassini RSS (and VGR) detections and 43 nondetections to a common epoch, using a comb of candidate  $n_P$ , and then folded them modulo the anticipated  $m$ -number of the corotational resonance (Prometheus  $m=110$  outer CER), to see if clustering appears. We find the "true F Ring core" is actually arranged in a series of short longitudinal arcs separated by nearly empty longitudes, orbiting at a well determined semimajor axis of 140222.4km (from 2005-2012 at least). Small particles seen by imaging and stellar occultations spread quickly in azimuth and obscure this clumpy structure. Small chaotic variations in the mean motion and/or apse longitude of Prometheus quickly become manifest in the F Ring core, and we suggest that the core must adapt to these changes for the F Ring to maintain stability over timescales of decades and longer.

PRESENTATION TYPE: Oral

CURRENT \* CATEGORY: Planetary Rings | Asteroids: Dynamics

CURRENT : None | None

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