



## Saturn's F ring, building a theory of it's structure

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The strange nature of Saturn's narrow F ring has provided a challenge for dynamicists since its discovery. Cassini has been returning images of the saturnian system for the last four years including many specifically designed to observe the F ring. There are now multiple Cassini Imaging Science Subsystem (ISS) F ring observations at low, medium and high resolutions, some with complete or nearly complete longitudinal coverage of the ring. This extensive coverage of the ring, both temporal and longitudinal, allows the challenge of developing of a complete theory of the F ring's structure to be attempted. The F ring displays unusual, unique features many of which vary on timescales of hours to years. The ring has multiple strands with a bright central core with extensive azimuthal structure. A regular series of streamer-channel features associated with Prometheus. "Jets" of material apparently ejected from disturbed regions of the core which eventually shear into "spiral ring" structures. Bright "clumps" of material that appear to be ephemeral in nature, some associated with the core or one of the strands while others seem detached. The mechanism by which Prometheus creates the observed streamer-channels features in the F ring is understood. However, gravitational interaction with known satellites is insufficient to explain the observed radial and azimuthal structure in the ring. There are indications of a population of smaller satellites associated with the F ring. Collisions of objects with the core of the F ring leads to the formation of the jets. Detailed examination of the evolving nature of small-scale azimuthal structure together with numerical modelling suggests small satellites embedded within the ring, eccentricities pumped up e.g. by the passage of Prometheus, create and maintain 'fans' and 'spikes' in the ring material leading to much of the observed azimuthal structure . Occultation data from Cassini's Ultraviolet Imaging Spectrograph (UVIS) have revealed the presence of objects with diameters

in the range 30m to 600m in the vicinity of the F ring.