

Photometry of giant propellers in Saturn's rings from close-range Cassini images

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“Propellers” are eponymously-shaped disturbances in Saturn’s rings centered on embedded moons (see [1] and references therein). In particular, a handful of “giant propellers,” created by km-size embedded moons [2], have predominantly keplerian orbits that have been shown to contain clear but enigmatic patterns of change as they have been tracked for over 10yr by frequent Cassini images [1].

During its Ring Grazing Orbits (RGO) and Grand Finale (GF), the Cassini spacecraft passed very close to the outer and inner edges (respectively) of Saturn’s main rings. During these maneuvers, the Cassini ISS camera executed a series of very high-resolution images of the main rings [3]. Among other priority science targets, several giant propellers were imaged at resolutions better than 0.4 km/pixel and high S/N. The propeller “Santos-Dumont” was imaged in this way during a single Cassini pass on both the lit and unlit sides of the rings (see Figure), revealing detailed structure of the propeller-disturbance in two very different photometric regimes [3].

The photometry of propellers has previously been found difficult to interpret [4,5]. We use the lit/unlit

pair of Santos-Dumont images as a “Rosetta Stone” to determine how the propeller’s photometry follows or deviates from classic Chandrasekhar theory.

We will present details and will discuss the implications.

References

- [1] Spahn F *et al.* (2018). Moonlets in dense planetary rings, in Tiscareno and Murray, eds., *Planetary Ring Systems* (Cambridge Univ. Press), 157.
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- [3] Tiscareno MS *et al.* (2019). Close-range remote sensing of Saturn’s rings during Cassini’s ring grazing orbits and grand finale. *Science*, in press.
- [4] Tiscareno MS *et al.* (2008). The population of propellers in Saturn’s A ring. *AJ* **135**, 1.
- [5] Tiscareno MS *et al.* (2010). An analytic parameterization of self-gravity wakes in Saturn’s rings. *AJ* **139**, 492.

Figure: Reprojected versions of images N1866363047 and N1866370342, showing the propeller Santos-Dumont on the lit and unlit sides of the rings, respectively. The unprojected resolutions of the images are 0.53 and 0.41

km px⁻¹, respectively. They have been reprojected to the same resolution, for comparison.

