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Analysis of Santos-Dumont's asymmetric propeller gaps

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Abstract

Among the great discoveries of the Cassini mission are the propeller-shaped structures created by small moonlets embedded in Saturn's dense rings. These moonlets are not massive enough to counteract the viscous ring diffusion to open and maintain circumferential gaps, distinguishing them from ring-moons like Pan and Daphnis.

However, *partial* gaps are one of the defining features of propeller structures. Until recently only the largest known propeller named Blériot was known to show well-formed partial gaps in images taken by the Narrow Angle Camera onboard the Cassini spacecraft. Since then, partial gaps were also resolved for the propellers Earhart and Santos-Dumont in high resolution images taken during Cassini's Ring Grazing Orbits.

We analyze images of the sunlit side of Saturn's outer A ring which show the propeller Santos-Dumont with clearly visible, azimuthally asymmetric gaps. We discuss relevant timescales for this asymmetry and interpret the azimuthal evolution in the context of a simple model of a librating moonlet [1], which links the asymmetric gaps to the reported propeller offset motion [2, 1, 3].

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