

Radial distribution of textures in Saturn’s main rings

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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 [1]. While hints of ring textures (clumpy, feathery, streaky, etc.) had been previously seen in some anomalously high-resolution images (e.g., [2]), the RGO/GF images constitute a complete radial survey for these structures, revealing that in many locations they occur in sharply defined radial bands that are not obviously correlated with other ring features.

In the figure, showing Plateau P1 and its environs in the C ring, the middle strip has been filtered by subtracting the average radial profile of the image, so that local structures and textures are more visible. The plateau itself exhibits a streaky texture, while the continuum C ring inward of the plateau exhibits a clumpy texture that is reminiscent of the troughs of spiral density waves in the A ring [1]. Between the two is a band with no discernible texture (i.e., “smooth”). Other radial texture bands, often similarly sharply defined, are seen in the A and B rings.

There is growing evidence that some of the more eye-catching sharply-bounded features in the main rings, such as the A ring inner edge and the C ring plateaux, are not due to changes in surface mass density (e.g., [3,4]) and thus must be due to variations in particle properties of some kind. Composition, particle size, and regolith character are candidates for various observed effects, though it is not yet clear why ring particles should be strongly sorted according to these properties. The strongly banded ring textures described here

provide another window onto this process. We speculate that they may be due to different ways in which ring particles bounce off each other when they collide, and thus might be correlated to regolith character. Be that as it may, further research is greatly needed.

We will present a “geological map” of the main rings, in terms of the textures observed in the RGO/GF images, and we will discuss the implications for ring particle character and interactions.

References

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- [3] Tiscareno MS *et al.* (2013). Probing the inner boundaries of Saturn’s A ring with the Iapetus –1:0 nodal bending wave. *Icarus* **224**, 201.
- [4] Hedman MM and Nicholson PD (2013). Kronoseismology: Using density waves in Saturn’s C ring to probe the planet’s interior. *Astron. J.* **146**, 12.

Figure: Plateau P1 and its environs in the C ring, with three different textures in close proximity to each other.

