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A comprehensive catalog of features in Saturn's rings from Cassini RSS, VIMS, and UVIS occultations

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Abstract

The most detailed pre-Cassini investigation of the geometry of Saturn's rings was published two decades ago as part of an effort to determine Saturn's pole direction and the radius scale for the ring system [1] (henceforth F93). This study was based on the Voyager 1 egress RSS ring occultation from 1980, the 1981 Voyager 2 egress PPS stellar occultation of δ Sco, and high-SNR earth-based 28 Sgr occultation measurements that were limited in radial resolution by the 20 km projected diameter of the occulted star; Bosh [2] expanded on these "historical" results by incorporating occultation results from the Hubble Space Telescope (HST). The wealth of Cassini occultation observations has provided detailed views of the structure of Saturn's rings at much higher spatial resolution and better SNR than ever before [3], especially in the optically thick B ring, and our Cassini-based orbit fits to the rings have provided important corrections to the F93 radius scale of the rings. The F93 results were based on orbit fits to 38 putatively circular features from an atlas of 66 numbered features visible in the Voyager and 28 Sgr data, with a grand total of 452 data points from three occultations fitted to obtain Saturn's pole direction and the ring radius scale. Compared to these solutions, we have increased the number of occultations from three to over 150 and the catalog of consistently identifiable, persistent sharp-edged features from 66 to over 300, mostly in the C and B rings, and the Cassini Division (the A ring is etched by almost innumerable density waves produced by Saturn's plethora of satellites). Figure 1 shows a portion of our updated atlas of features. We have determined the orbital elements of all of these features, with an estimated accuracy of $\sim$250 m in orbital radius. Much of the newly-explored structure in the B ring is poorly understood, and may represent viscous overstabilities in the denser parts of the rings [3]; these accurate orbit solutions, coupled with the decade timescale of the Cassini observations, will enable us to set limits on possible changes in the locations of these abrupt features. The comprehensive catalog, accurately registered in absolute radius, will also provide a guide to other investigators who wish to determine the absolute radius of nearby features in imaging and occultation observations.

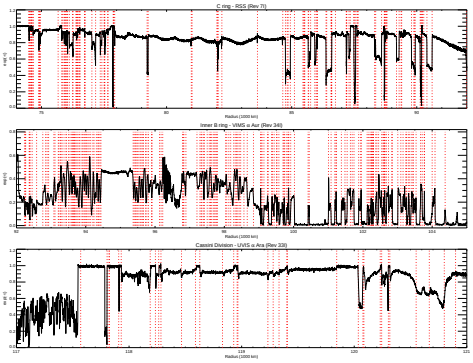

Figure 1: A view of the C ring, inner B ring, and Cassini Division, as seen in Cassini RSS, VIMS, and UVIS occultations, showing a plethora of sharp-edged circular and non-circular features (marked in red) included in our comprehensive catalog of ring features.

Acknowledgements

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References

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