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UVIS Observations of B-Ring Outer Edge: Comparisons to F-Ring

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Abstract

Observations by Cassini's UVIS instrument show highly perturbed, transient structures in the F ring and at the outer edge of the B ring. These features are much more extreme than predicted by models that assume the rings behave like a fluid. Like the F ring structures, the B ring outer edge wanders unpredictably; Multiple structures are evident: jagged peaks, plateaus, gradual gradients; Spectral analysis indicates structures having widths 200-2000 meters, even more erratic than the F ring. This spectral behavior is only seen at the F ring, the B ring outer edge and at the strongest density waves in the A ring. These structures are transient, apparent at some longitudes and absent at others. They may result from temporary aggregations like those inferred from images by Murray etal and from UVIS and VIMS occultations by Esposito etal. This is consistent with evidence for accretion from the shapes and density of small moons near the rings (Porco etal, Charnoz etal). Possible explanations of this chaotic behavior are the repeated strong gravity of moons tugging on ring particles causes them to jam together: these 'traffic jams' are evident in the computer simulations of Lewis and Stewart; attraction among the ring particles creates temporary clumps that further disrupt the rings around them. Thus, the exotic F ring structures have parallels in the main rings: similar processes of tidally limited accretion (Barbara and Esposito
2002) may be occurring there. This has direct implications for protoplanetary disks where clumps and propeller structures (Tiscareno etal) may be intermediate stages of planet formation.