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Sizes of Particles, Clumps, and Holes in Saturn's Rings from Cassini UVIS Stellar Occultation Statistics in Highly Resolved Ring Structure

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The high speed photometer (HSP) of Cassini's Ultraviolet Imaging Spectrograph (UVIS) observed 275 ring stellar occultations with a multitude of different viewing geometries, revealing new information about the three dimensional structure of the rings. UVIS stellar occultation data are described by Poisson statistics such that the variance equals the mean when there is no ring material obstructing the view of the instrument. Due to the stochastic nature of the positions of the largest ring particles, we observe an excess variance related to the sizes of the largest particles or clumps present in the area over which light is collected during each measurement. Colwell et al. (2018, Icarus, 300, 150) analyzed the excess variance across the rings in two UVIS occultations, but did not fully account for the effects of the scattered signal in determining the measurement area. We extend the work of Colwell et al. (2018) by removing trends in narrow, highly resolved regions of the data due to variations in optical depth on scales of 100s to 1000s of meters. Through trend removal, we modify the data to allow for an analysis of excess variance due to finite particle or clump sizes within regions where there is structure in the rings, such as within the peaks and troughs of density waves and at the edges of ringlets and plateaus. We further extend the results of Colwell et al. (2018) by combining measurements from multiple occultations made at several different viewing geometries. Different line-of-sight distances affect the measurement area due to the scattered signal and diffraction, while different viewing angles provide measurements of the same ring material with different line-of-sight optical depths. We will present results from the Cassini ring stellar occultations with comparisons to Monte Carlo simulations of the distribution of ring particle sizes and holes in the rings that incorporate the effects of diffraction.