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Size of particles and clumps in Saturnian rings inferred from Cassini UVIS occultations

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The multiple Cassini UVIS stellar occultations reveal the Saturnian rings with an unprecedented resolution. Here we present a new formalism for the explanation of the statistical properties of the occultation data. The observed variance of the occultation data of the rings is clearly above the Poisson prediction, and we show that the difference is related to either largest particles or the ring microstructures or both. The analysis of the UVIS occulatation data for Saturn's A ring gives the characteristic size between few and dozen of meters with a clear maximum in the middle of A ring. The difference in multiple UVIS occulation profiles can only be reconciled with Saturn's A ring containing numerous microstructures or ephemeral agglomerations of particles. Together with analysis of the optical depth variations in UVIS occultation profiles under different observation geometries leads us to a conclusion that the A ring consists of Toomre type self-gravity wakes. The observed excess variance is then primarily induced by the present self-gravity wakes and inferred characteristic length is the average size of the wakes.