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Spatially resolved self-gravity wakes in Saturn's A and B rings from Cassini UVIS occultations

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After 6 years of Cassini mission the UVIS instrument recorded more than hundred stellar occultations by Saturn's rings. Most of the observed occultations have excellent spatial resolution on the order of ten meters or even better. In a recent, specially crafted high-resolution occultation of the mid A ring we for the first time directly resolved individual self-gravity wakes. The occultation was designed to track the orbital motion of ring particles, achieving the true resolution in the co-rotating ring plane of less than a meter. In this unique occultation the self-gravity wakes manifest themselves as opaque or nearly opaque regions (tau>1.5) and constitute about 30% of the total occultation signal. The observed wake lengths can be as large as 200m. Another 30% of the ring is practically transparent (tau<0.05), and somewhat shorter (L<100m). The opaque and transparent regions are interspersed with material in an intermittent state (0.05<tau<1.5). This picture reveals that self-gravity wakes and accompanying nearly transparent gaps constantly form and disperse, while the intermittent dispersed state makes 40% of the observed ring. The inferred properties of self-gravity wakes in Saturn's A ring are consistent with published self-gravity wake models of Colwell et all (GRL, 2006) and Hedmann et all (AJ, 2007).

Although Saturn's B ring has been observed in UVIS only at moderate spatial resolutions (true resolution of dozen meters in the co-rotating ring plane), a different image is emerging. Contrary to the published models (Colwell et all, Hedmann et all) we note a lack of low optical depth regions at the smallest scale. It appears that the self-gravity wakes of the B ring are either very different in nature than imagined up to now, or they are much smaller than their A ring counterparts. The later possibility would imply either a surprisingly under-dense B ring, or a very dynamically hot environment.