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Thermal modelling os self-gravity wakes

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Self Gravity wakes in the Saturn's A ring have been intensively studied with the Cassini spacecraft since the SOI in July 2004. These gravitational instabilities reveal the effects of both the mutual gravitation and the important shearing due to the Keplerian rotation in Saturn's rings. Numerical simulations of the ring local dynamics including collisions and self-gravity show that wakes are elongated small scaled structures, forming a pitch angle of about 70 deg with the radial direction. Their typical size is about 100 meters, and they seem to be continuously generated and destroyed.

Azimuthal variations of reflected light in visible wavelengths are explained by the presence of these structures, the ring's brightness being highest when wakes are perpendicular to the line of sight. Their cross section decreases when they are aligned with the line of sight, that decreases the ring's brightness. Azimuthal variations of ring's transmition have also been observed during stellar occultations (Colwell et al. 2006, Hedman et al., 2007, French et al, 2007). It provides good insight about radial variations of wakes morphology (height, spacing, width). Variations of infrared emissivity have also been detected with CIRS data (Ferrari et al., 2005). From variations of the filling factor observed in 12 observations of the A ring, performed at spacecraft elevation ranging from 16 to 50 deg, we can derive typical wakes dimensions that are consistent with results already obtained in different wavelengths. The ring infrared emission depends also strongly on the dynamical history of particles in wakes. Using a new thermal modelling of wakes, we show that wakes are very ephemeral. We present new insights of local dynamics in wakes from infrared data.