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Azimuthal temperature variations of Saturn's main rings as observed by CIRS/CASSINI: first implications on particle properties and dynamics

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The first season of the CASSINI-CIRS Composite Infrared Spectrometer exploration of Saturn's ring world is completed. Thanks to its large coverage of the infrared domain (7-1000 μm), CIRS is able to detect the peak of thermal emission of icy bodies at Saturn's distance and its focal plane FP1 is perfectly adapted to scrutinize ring temperatures. Temperatures are driven by the thermal properties of ring particles and their local dynamics like vertical excursion or proper rotation, i.e. spin. Azimuthal temperature profiles of the three main rings A, B and C have been successfully acquired between July 2004 and August 2005. They provide rings temperature and emissivity as a function of orbital longitude for a few phase angles, on both sun lit and unlit faces. Transient temperature regimes at the entry and exit of the shadow have been observed and provide constraints on the thermal properties of ring particles. Variations of ring temperature with phase angle provide constraints on their rotational properties. Data shows that the thermal emission of all main rings is decreasing with increasing phase angle which is typical of a population slowly rotating particles. The detection of a transient regime around the shadow boundary in the C ring at high phase angle also implies that a population of fast rotating particles is present in this ring. Temperatures variations along the A ring are shown to be correlated with the observer position and to obey a quadrupole asymmetry, which is certainly created by gravitational instabilities in the ring (also called gravity wakes). CIRS therefore provides a quantitative estimate of the variation of filling factor due to wakes from which their physical properties can be derived, using results of local numerical simulations. We will present all these results and implications on the local dynamics and physical properties of ring particles

and disk.