Cassini CIRS Observations of Saturn's Rings

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A great deal can be learned about Saturn's rings at infrared wavelengths. The Cassini Composite Infrared Spectrometer (CIRS) will provide spectral data from 7 to 500 microns (1400 to 20 cm-1) over the four-year nominal mission. CIRS will make observations of the lit and dark faces of rings over a range of geometries including high and low phase angles, across shadow boundaries and over a variety of emission angles. These measurements will provide important information on the vertical thermal gradient, and on the temperature contrast between night and day sides of particles. Plans for Cassini CIRS observations of Saturn's rings will be presented.

CIRS capabilities will provide major advances over previous spacecraft infrared observations of the Saturn's rings, including the stated extension of the spectral range to submillimeter wavelengths and the use of linear arrays with much improved spatial resolution in the mid-infrared wavelength range. Between 50 and 500 microns (200 and 20 cm-1), the absorption coefficient of water ice at 100 K decreases by approximately four orders of magnitude, making the material progressively more transparent. In this wavelength range, the unit optical depth in pure ice moves from a physical depth of ~10 microns to ~10 cm. This change in optical constants is primarily responsible for the dramatic variation at long wavelengths in the spectrum of Saturn's rings, which changes from nearly blackbody emission at 50 microns to essentially reflected planetary radiation by 1 cm. This gives CIRS the ability to probe icy surfaces to various depths, thus providing a powerful tool for the investigation of the composition and physical properties of ring particles.

CIRS can address many of the key ring objectives of the Cassini mission, including composition, ring particle thermal properties and rotation states, radial thermal structure, and vertical thickness. Particle properties can be derived from these constraints.

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