

Cassini CIRS observations of thermal differences in Saturn's main rings with increasing phase angle

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The Cassini Composite Infrared Spectrometer (CIRS) obtained spatially resolved thermal infrared scans of Saturn's main rings (A, B and C, and Cassini Division) that show ring temperatures decreasing with increasing solar phase angle on both the lit and unlit sides of the rings. These temperature differences with phase suggest that Saturn's main rings include a population of relatively large, fairly slowly spinning particles with a thermal conductivity that is low enough to provide a thermal response that is fast compared to the particle rotation period.

For the B and A rings, the temperature is correlated with optical thickness when viewed from the lit side, and anti-correlated when viewed from the unlit side. On the unlit side of the B ring, not only do the lowest temperatures correlate with the largest optical depths, but these temperatures are the same at both low and high phase angles, suggesting that little sunlight is penetrating these regions and that vertical mixing is limited across the densest part of the B ring.

The A ring shows the smallest temperature variation with phase angle, and this variation decreases with increasing ring radius. This decrease in thermal contrast suggests a larger number of smaller, and/or more rapidly rotating ring particles which have more uniform temperatures with phase angle, resulting perhaps from stirring by density waves and gravitational wakes.

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