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The Thermal Infrared Investigation on Cassini: A Challenge for Laboratory Studies

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The Composite Infrared Spectrometer (CIRS) has been recording spectra of Saturn and Titan for nearly six years as part of the Cassini mission. CIRS is a Fourier transform spectrometer that covers the thermal infrared from 10 to 1500 cm^{-1} with high spatial and spectral resolution and which can observe in both nadir and limb geometries (Flasar et al. 2004). The large volume of spectra collected during the mission provides temperature, dynamics and composition sounding of the tropospheres and stratospheres and covers all latitudes and longitudes. Seasonal changes are being tracked as the Saturn system moves from winter into spring in the north.

Results from CIRS have raised a variety of questions that will only be answered with the help of new laboratory studies. Ongoing analyses have shown that a complete understanding of the CIRS high-resolution atmospheric spectra requires new or improved line positions and intensities for certain trace molecules (e.g., Nixon et al. 2009). Improved line parameters are also needed for isotopic variants of some of the more abundant species (e.g., Coustenis et al. 2007 and Fletcher et al. 2009). Aerosol and haze features that appear in the CIRS spectra will not be fully explained without better knowledge of how these materials are formed and without further laboratory measurements of their spectra. Atmospheric history can be deduced in part from observed isotopic ratios if experimental fractionation rates are available (Jennings et al. 2009). The interplay between the CIRS investigation and laboratory research has already produced new discoveries.

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