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Studies of Saturn's rings from UV to far IR: Constraints on Saturn ring particle properties and ring structure

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Abstract

Modeling the changes in brightness, color, temperature and spectral parameters, significant progress can be made in understanding the character of Saturn's ring particles and their regoliths with changing viewing geometry. We are studying Saturn's rings over a wide range of wavelengths, from ultraviolet through the thermal infrared. Preliminary results from our joint studies will be presented.

1. Introduction

Data from Cassini's Composite Infrared Spectrometer (CIRS), Visual and Infrared Mapping Spectrometer (VIMS), Imaging Science Subsystem (ISS) and Ultraviolet Imaging Spectrograph (UVIS) are jointly being studied using scans of the lit and unlit main rings (A, B, C and Cassini Division) at multiple geometries and solar elevations. Using multi-wavelength data sets allows us to test different thermal models by combining effects of particle albedo, regolith grain size and surface roughness with thermal emissivity and inertia, and particle spin rate and spin axis orientation. With the high spatial resolution of the Cassini data it is now possible to analyze these effects at smaller spatial scales and characterize regions such as the C ring plateaus and ringlets, where albedo differences may be present.

2. Summary and Conclusions

The CIRS temperature and ISS color variations are confined primarily to phase angle over a range of solar elevations with only small differences from changing spacecraft elevation. Color and temperature dependence with varying solar elevation angle are also observed. Brightness dependence with changing solar elevation angle and phase angle is observed with UVIS. VIMS observations show that IR water ice absorption band depths are a very weak function of phase angle, out to ~140 deg phase, suggesting that interparticle light scattering is relatively unimportant except at very high phase angles. These results imply that the individual properties of the ring particles may play a larger role than the collective properties of the rings, in particular at visible wavelengths. The temperature and color variation with phase angle may be a result of scattering within the regolith and on possibly rough surfaces of the clumps, as well as a contribution from scattering between individual particles in a many-particle-thick layer.

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