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Multi-wavelength studies of Saturn's rings to constrain ring particle properties and ring structure: the VIMS perspective

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Saturn has the most prominent and complex ring system in our solar system, extending along radial axis from 74658 km (inner C ring edge) to 136780 km (outer A). The physical and dynamical properties of ring particles can be fully understood only using a broad spectral range, which allow us to recognize very different processes. In this context, the scientific goal of our investigation is the study of Saturn's rings particle properties using combined datasets returned from different instruments aboard the Cassini mission. We are merging rings observations and compare results collected by Cassini's UV Imaging Spectrometer (UVIS), Imaging Science Subsystem (ISS), Visual and Infrared Mapping Spectrometer (VIMS) and Composite Infrared Spectrometer (CIRS). Merging multi-wavelength data sets allow us to test different thermal models, combining the effects of particle albedo, regolith composition, grain size and thermal properties with the ring structure. In this work we report about the VIMS contributions to this investigation, coming from the analysis of 0.35-5.1 μm spectra of A, B, C rings and Cassini Division. VIMS, in fact, has the capabilities to determine ring particles composition (water ice vs. chromophores mixed within ice), surface regolith grain size and particle albedo. After having described the dataset considered in this work (several rings radial mosaics taken at $12^\circ \leq$ phase $\leq 136^\circ$ and $-21^\circ \leq$ opening angle $\leq +5^\circ$) and the method to reduce data to spectrograms, we explain how the spectral indicators we have selected (slopes and band parameters) allow us to infer ring particle properties across different regions. Specifically, we report about: 1) the variations induced by illumination phase on visible reddening and water ice bands depth; 2) the average composition and regolith grain size of ring particles in A, B, C rings and CD; 3) an application of Hapke's model to compare VIMS data with synthetic spectra.