**REVISED FULL-DISK SPECTRA BY CASSINI-VIMS OF THE SATURNIAN MINOR ICY MOONS.**

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**Introduction:** During the last months we have performed a detailed re-analysis of the disk-integrated spectra of the minor moons of Saturn obtained by Cassini-VIMS. This activity was made to verify if the spectral analogies we have observed in the past between Epimetheus and Hyperion were real or not [1]. After a detailed study of the temporal sequencing and checks on the observations geometry we arrive to the conclusion that we have erroneously assigned some VIMS observations of Hyperion to Epimetheus and Janus. This effect has generetad a misleading interpretation of the results. Having corrected these critical observations, we have improved our understanding of the minor satellites spectral properties. From these data results that Janus visible slopes are slightly red, e.g. intermediate between Hyperion-Iapetus (leading hemisphere) and the rest of the satellites while Epimetheus is more neutral and similar to Iapetus (trailing hemisphere), Mimas and Tethys. Therefore the differences between Janus and Epimetheus are less evident respect to our previous results. Moreover there could be some differences in the visible reddening between the north and south hemispheres of Janus. The two shepherd moons of the F ring, Prometheus and Pandora, are similar to Atlas while the two lagrangian moons of Tethys, Calypso and Telesto, have visible blue color and well-shaped water ice bands indicative of a fresh surface.

**Spectral variability of the minor satellites:** A statistical study of the spectral properties of the icy satellites by using disk-integrated I/F obtained by VIMS during Cassini's nominal mission is currently under realization with the method explained in [2]. More than 1400 observations of both regular and minor satellites have been processed [3], with the more numerous datasets for the regular satellites. Concerning the minor moons we have one useful observation respectively for Atlas, Prometheus, Pandora and Epimetheus; 2 for Telesto; 4 for Calypso and 46 for Janus. At this stage we have processed only pointed observations: the data-mining among serendipitous observations requiring more efforts. The resulting disk-integrated I/F of the minor satellites are shown in Fig. 1. In the visible range Atlas, Prometheus, Pandora and Janus are characterized by a step red slope for $\lambda<0.55$ μm which become less intense on Epimetheus, Calypso and Telesto. In the $0.55<\lambda<1.0$ μm range both Epimetheus and Janus are slightly red; Atlas, Prometheus and Pandora are almost neutral while Calypso and Telesto are blue. This effect seems to be correlated with the presence of a UV absorber, more abundant on the "red" surfaces. Calypso and Telesto therefore appear quite blue and coated by more pure water ice. In the IR range the main features of the water ice are detected as well: the bands at 1.5, 2.05, 3.0 μm are evident on each satellite. The faint 1.05 and 1.25 μm bands are detected only on Calypso. In some cases is visible the Fresnel peak at 3.1 μm. The low SNR characterizing these observations don't allow to recognize any spectral feature for $\lambda>4$ μm.

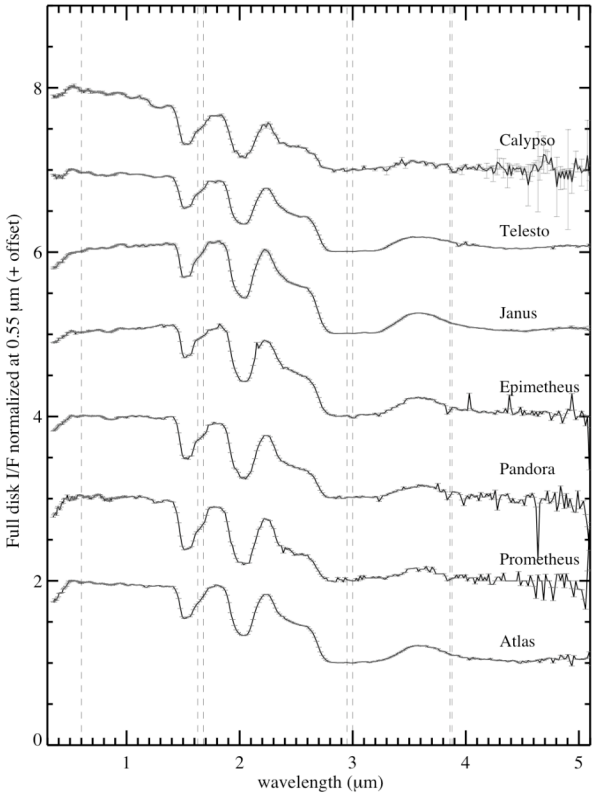


**Fig. 1**. Averaged disk-integrated spectra of the minor satellites of Saturn. Vertical lines indicate the 4 order sorting filters of the instrument.

**Latitudinal variations on Janus?** A possible compositional variability can exists between the north and south hemispheres of Janus. We come to this conclusion after having analyzed two different sequences of observations obtained by VIMS with a subspacecraft (SSC) latitude of +45° (17th may 2008) and -73° (26th may 2008). The solar phase angle is equal to 98° and 83°, respectively. From these data result that the visible spectrum obtained on the southern hemisphere is more red respect to the northern both in the 0.35-0.55 μm and in the 0.55-1.3 μm ranges (Fig. 2). As the two dataset were obtained with a similar solar phase angle we should exclude that the illumination geometry can be responsible of a similar spectral variation. Despite this effect we cannot recognize any substantial difference between the two spectra in the 2.5-5.0 μm region. In particular the 3.6 μm peak, which is highly sensitive to both regolith grains sizes and temperature, is equal on the two hemispheres. These arguments suggest the presence of more abundant "contaminants" on the southern regions of Janus. A similar reddening in the visible range without any strong IR features can be reproduced by small quantities of Nanohematite (very fine-grained hematite or $Fe_2O_3$) [4].

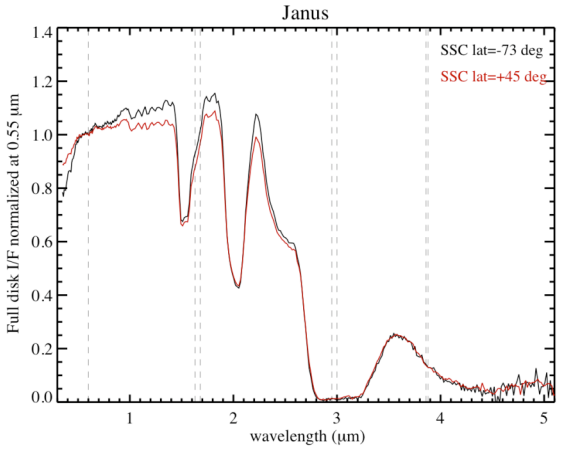


**Fig. 2**. Janus mean spectra on north (SSC lat +45°) and south (SSC lat -73°) hemispheres. The south hemisphere spectrum has a steeper red slope in the VIS range. The "bumps" in the 1.0-1.4 μm range are calibration residuals.

**Conclusions:** Starting from the first results we have obtained [5], the observations of the minor moons of Saturn by VIMS remains an important scientific objective for the Cassini extended mission because these objects are difficult target to be observed from Earth. The characterization of their surfaces compositions will require more numerous observations in order to improve the signal to noise conditions, explore different illumination geometries and observe different regions. These data will be of great interest to better define the evolution and dynamics of minor bodies and rings in the Saturn system.

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