Geophysical Research Abstracts
Vol. 12, EGU2010-1906-1, 2010
EGU General Assembly 2010

Saturn's system ices: a comparative spectral study by Cassini-VIMS

Gianrico Filacchione (1), Fabrizio Capaccioni (1), Roger N. Clark (2), Jeff N. Cuzzi (3), Dale P. Cruikshank (3), Angioletta Coradini (4), Priscilla Cerroni (1), Federico Tosi (4), Mauro Ciarniello (1), Phil D. Nicholson (5), Thomas B. McCord (6), Robert H. Brown (7), Bonnie J. Buratti (8), Ralf Jaumann (9), and Katrin Stephan (9)

(1) INAF-IASF, via del Fosso del Cavaliere, 100, Rome, Italy (gianrico.filacchione@iasf-roma.inaf.it), (2) U.S. Geological Survey, Denver, CO, USA, (3) NASA Ames Research Center, Moffett Field, CA, USA, (4) INAF-IFSI, via del Fosso del Cavaliere, 100, Rome, Italy, (5) Cornell University, Astronomy Department, Ithaca, NY, USA, (6) PSI NW and University of Hawaii, USA, (7) University of Arizona, USA, (8) JPL, USA, (9) DLR, Germany

The Visual and Infrared Mapping Spectrometer (VIMS) has observed the entire population of Saturnian icy objects, allowing a comparative analysis of the VIS-NIR spectral properties of the regular satellites (Mimas, Enceladus, Tethys, Dione, Rhea, Hyperion, Iapetus, Phoebe), minor moons (Atlas, Prometheus, Pandora, Janus, Epimetheus, Telesto, Calypso) and main rings (A, B, C and Cassini division). The results we present are derived from the entire dataset available after about 5 years of the Cassini mission, which consists of more than 2000 full-disk observations of the moons as well as several radial mosaics of the ring system. The spectra of Saturn's satellites are characterized by a step red slope in the 0.35-0.55 μm range, which is highly diagnostic of the presence of organic contaminants and darkening agents on icy surfaces; in the 0.55-0.95 μm range the spectra become more flat and featureless. In the IR range the water ice bands at 1.5-2.0-3.0 μm bands are evident everywhere, while the CO2 ice band at 4.26 μm is seen only on the three external satellites Hyperion, Iapetus and Phoebe.
Some specific spectrophotometric indicators are chosen to retrieve the macroscopic properties of the ices: I/F continuum levels, 0.35-0.55 and 0.55-0.95 μm spectral slopes, H2O-CO2 ice band depths and band positions.
By using these indicators the Saturn's satellites are grouped in distinct classes, noticeably between the almost pure water ice and blue surfaces of Enceladus and Calypso to the organic- and carbon dioxide-rich Hyperion, Iapetus and Phoebe. Hyperion and the leading hemisphere of Iapetus have the reddest VIS slopes of the group. Janus' visible colors are intermediate between these two classes having a slightly positive VIS spectral slope, while Epimetheus is more neutral and similar to Iapetus' bright terrains (trailing hemisphere), Mimas and Tethys. The two F ring's shepherd moons, Prometheus and Pandora, have similarities with Atlas, while Calypso and Telesto show VIS blue color and well-shaped H2O ice bands indicative of a fresh surface.
On the disk-integrated spectra processed in this work is in general very difficult to recognize more spectral features that become evident only at high spatial resolution.
At VIS wavelengths the main rings appear more red respect to the icy satellites while in the IR range they show more intense water ice bands, thus denoting a minimal presence of "contaminants" that should be intimately mixed inside the ice grains.
Thanks to this comparative approach it is possible to classify the spectral characteristics of the different objects orbiting around Saturn as well as to measure the radial variability of water ice, carbon dioxide ice and contaminants across the system from the inner C ring (radial distance 75,000 km) to Phoebe (12,952,000 km): these results could help to decipher the origins and evolutionary history of the Saturn's system.