Close Window

2010 AGU Fall Meeting

You may print by clicking on this Print *button. To return to the previous page, close this browser window or click the 'X' button in the top right corner of the page.*

ID# P21C-08
Location: 306 (Moscone South)
Time of Presentation: Dec 14 9:45 AM - 10:00 AM

Compositional radial variability in the Saturn's system observed by Cassini-VIMS (INVITED) (*Invited*)

G. Filacchione[1]; F. Capaccioni[1]; R. N. Clark[2]; R. H. Brown[3]; J. N. Cuzzi[4]; B. J. Buratti[5]; A. Coradini[6]; J. I. Lunine[3, 6]; P. Cerroni[1]; F. Tosi[6]; M. Ciarniello[1]; D. P. Cruikshank[4]; R. Jaumann[7]; P. D. Nicholson[8]; K. Stephan[7]; R. Nelson[5]; K. H. Baines[9]
1. INAF-IASF, Roma, Italy.
2. USGS, Denver, CO, United States.
3. University of Arizona, Tucson, AZ, United States.
4. NASA-AMES, Moffett Field, CA, United States.
5. NASA-JPL, Pasadena, CA, United States.
6. INAF-IFSI, Roma, Italy.
7. DLR, Berlin, Germany.
8. Cornell University, Ithaca, NY, United States.
9. SSEC, University of Wisconsin-Madison, Madison, WI, United States.

From ~2200 disk-integrated observations of the moons and several radial mosaics of the rings acquired by Cassini-VIMS, we have found very striking differences among the various objects in the Saturn system, ranging from the almost uncontaminated and water ice-rich surfaces of Enceladus and Calypso to the metal/organic-rich and red surfaces of Iapetus' leading hemisphere and Phoebe. In this framework, we have investigated the relationships between the satellite surface composition, orbital distance from Saturn, and average density.
In the F ring environment, the inner satellites (Prometheus, Pandora, Janus and Epimetheus) have average surface water ice abundances similar to particles in the C ring and CD but with much less reddening contaminant. Although their orbits are close to the F-ring, Prometheus and Pandora have very evident differences in surface composition: Prometheus is very water ice-rich but at the same time very red at VIS wavelengths. These properties make it very similar to A-B ring particles while Pandora is bluer. Moving outward, the effects of E ring particles, generated by Enceladus plumes become evident as they contaminate surfaces from Mimas to Rhea. We have found some differences between the Lagrangian moons of Tethys: Calypso is much more water ice-rich and bluer with respect to Telesto. Among the outer satellites, moving from Hyperion, to Iapetus and Phoebe, a linear trend is observed relating the decrease of water ice to reddening, with Hyperion resulting as the reddest object of the population.
As a further step, we have investigated how these surface properties are correlated with the average densities and dimensions of the moons. Mid-sized icy satellites are in a transition regime, between the high pressure/high density ice phases of Titan and the high porosity/irregular shapes of the minor moons and Hyperion. Low-density (0.5-1.0 g cm-3) satellites show different trends with Prometheus, Pandora and Calypso characterized by high abundance of surface water ice while Janus and Hyperion are ice-poorer and redder. Higher densities, ranging between 1.0 and 1.6 g cm-3, are typical of the regular satellites which, with the exclusion of Dione and Rhea, have similar water ice abundances. For Iapetus, if we exclude the exogenic dark material covering the leading hemisphere, we find water ice abundances similar to the remaining regular satellites. Finally Phoebe has the greatest density (1.65 g cm-3) of the population and the least water ice abundance. Since VIS-IR spectra can probe surface composition only in a very shallow layer a few wavelengths deep, VIMS measurements are affected by

the presence of exogenic particles and processes. However these measurements, when coupled with the results coming from other Cassini orbiter experiments and theoretical models, promise to help us unveil the formation and evolution history of the Saturn's system.
This research is supported by an ASI grant

Contact Information
Gianrico Filacchione, Roma, Italy, 00133, click here to send an email