Mem. S.A.It. Vol. 87, 190

Memorie della

Cassini-VIMS temperature maps of Saturn's satellites

G. Filacchione[1], F. Capaccioni[1], M. Ciarniello[1], F. Tosi[1], E. D'Aversa[1], R.N. Clark[2], R.H. Brown[3], B.J. Buratti[4], D.P. Cruikshank[5], M.C. Dalle Ore[5], F. Scipioni[6], and P. Cerroni[1]

[1] INAF-IAPS, via Fosso del Cavaliere 100, I-00133, Rome, Italy
[2] PSI Planetary Science Institute, 1700 East Fort Lowell, Suite 106, Tucson, AZ 85719-2395, USA
[3] University of Arizona - Lunar and Planetary Laboratory, 1629 E University Blvd, Tucson, AZ 85721-0092, Tucson, AZ, USA
[4] NASA-JPL, 4800 Oak Groove Drive, Pasadena, CA 91109, USA
[5] NASA-AMES, Moffett Field, CA 94035, USA
[6] LPI-USRA, 3600 Bay Area Blvd, Houston, TX 77058, USA

Abstract.

The spectral position of the 3.6 μm continuum peak measured on Cassini-VIMS reflectance spectra is used to infer the temperature of the regolith particles covering the surfaces of Saturn's icy satellites.

Laboratory measurements by Clark et al. (2012) have shown that 3.6 μm peak for pure crystalline water ice particles shifts towards shorter wavelengths when the sample is cooled, moving from about 3.65 μm at T=123 K to about 3.55 μm at T=88 K. A similar trend is observed also in the imaginary part (k) of the refractive index of water ice when the sample is cooled from T=140 K to 20 K (Mastrapa et al. 2009).

Since water ice is the dominant endmember on Saturn's satellites surfaces (Filacchione et al. 2012), the measurement of the wavelength at which the 3.6 μm reflectance peak occurs can be considered as a temperature indicator.

We report about temperature maps of Mimas, Enceladus, Tethys, Dione and Rhea derived by applying this method to Cassini-VIMS data taken at spatial resolution of 20-40 km/pixel. These maps allow us to correlate the temperature distribution with solar illumination conditions and with geological features. On average Enceladus' midlatitudes regions appear at T<100 K while the south pole tiger-stripes active area shows a thermal emission at T>115 K. Tethys' and Mimas' equatorial lenses show significant thermal anomalies: despite these features have low visible albedo they appear more cold than the surrounding mid-latitude regions as a consequence of a much higher thermal inertia. On Mimas, Hershel crater's floor appears warmer (T>115 K) than the adjacent equatorial lens area (T<110 K). Finally, Dione's analysis evidences lower temperature across the bright wispy terrains than the nearby low albedo areas.

References

Clark, R. N., Cruikshank, D. P., Jaumann, R., et al. 2012, Icarus, 218, 831
Filacchione, G., Capaccioni, F., Ciarniello, M., et al. 2012, Icarus, 220, 1064
Mastrapa, R. M., Sandford, S. A., Roush, T. L., Cruikshank, D. P., & Dalle Ore, C M. 2009, ApJ, 701, 1347