CASSINI-VIMS OBSERVATIONS OF SATURN'S MAIN RINGS. G. Filacchione[1], F. Capaccioni[1], A. Coradini[2], P. Cerroni[1], F. Tosi[2], G. Bellucci[2], R. H. Brown[3], K. H. Baines[4], B. J. Buratti[4], R. N. Clark[5], P. D. Nicholson[6], R. M. Nelson[4], J. N. Cuzzi[7], T. B. McCord[8], M. H. Hedman[6], M. R. Showalter[9], [1]INAF-IASF, via del Fosso del Cavaliere, 100, 00133, Rome, Italy, gianrico.filacchione@iasf-roma.inaf.it , [2]INAF-IFSI, via del Fosso del Cavaliere, 100, 00133, Rome, Italy, [3]Lunar and Planetary Lab, University of Arizona, Tucson, AZ, USA, [4]Jet Propulsion Laboratory, Pasadena, CA, USA, [5]US Geological Survey, Denver, CO, USA, [6]Cornell University, Department of Astronomy, Ithaca, NY, USA, [7]NASA AMES Research Center, Moffett Field, CA, USA, [8]Space Science Institute NW, Winthrop, WA, USA, [9]SETI Institute, Mountain View, CA, USA.

Introduction: The rings of Saturn are one of the main scientific objectives of VIMS experiment aboard Cassini: we report here some preliminary results retrieved through the analysis of the main rings (C, B, A) hyperspectral data in the 350-5050 nm range. The spectroradiometric properties of the rings along the radial axis are investigated through the analysis of the visible spectral slopes (in the blue-green and in the red ranges), water ice band strengths (at 1050, 1250, 1500, 2050, 3000 nm) and reflectance levels (at 550, 3098 and 3580 nm): these quantities are indicators of the amount of contaminants on water ice and of the grain sizes.

Data processing: The imaging capabilities of VIMS allows to study in detail the spectroradiometric properties of the Saturn's rings and to map their composition along the radial axis. We report here the results retrieved from the processing of a medium resolution mosaic of the main rings (A-B-C) taken on 18th august 2005; the observation was made at a distance from Saturn of 1.103.000 km with a phase angle of 28° and with a ring opening angle equal to 21.9° (observation in reflectance). The resulting VIS (350-1050 nm) mosaic is 380x48 pixels wide while the IR (850-5050 nm) mosaic is 272x96 pixels; the dimensions of the two mosaics depend to the different instruments IFOV (166 μm for the VIS and 250x500 μm for the IR). Assuming azimuthal homogeneity over the region of the rings observed in the two mosaics, we can sort the spectra along the radial crescent direction to build up a spectrogram (radius vs wavelength, see Figure 1); the data shown are interpolated at a resolution of 200 km/pixel to reduce oversampling effects; VIS and IR spectra are bridged together around 950 nm.

VIS range: in the visible range the rings' spectra appear featureless with a steep slope in the blue range which becomes flat in the red (Figure 2). This behavior is compatible with a mixture of water ice grains and small quantities of contaminants [1]. The relative distribution of contaminants across the rings can be measured through the blue slope [2,3]: lower values of I/F observed across the C ring, Cassini division and inner part of the A ring correspond to more contaminated water ice grains (Figure 3, top panel). Some significant variations of the slopes observed in the I/F spectra of the bright ringlets in C ring (at R_s=82.600 km) could be real (strong organics contamination) or an instrumental effect (i.e. spectral tilt) [4].

IR range: the absorption bands of the water ice at 1050, 1250, 1500, 2050, 3000 are detected across the whole rings system; the radial variations of the bands strengths (Figure 3, center panel) are strongly correlated with the visible blue slope: in correspondence of the C ring, Cassini Division and inner A ring we observe less saturated bands as consequence of a major concentration of contaminants. The fresnel peak at 3098 nm is present in the whole ring system but seems to be more intense across the C ring (Figure 3, bottom panel). This feature is compatible both with amorphous and crystalline water ice; unfortunately the presence of an instrument order sorting filter placed near 1650 nm doesn't allow us to discriminate the presence of the faint secondary band of the crystalline ice placed on the right wing of the strong 1500 nm band. The dimension of the water ice "regolith" grains covering the rings moonlets can determined thanks to the band strengths and to the continuum level around 3580 nm: these quantities in fact depend strongly on the dimension of the ring particles. In the A and B rings the 1500-2050 nm band strengths are equal to 0.5-0.7, compatible with grain sizes of 20-40 μm while in the C ring and Cassini division are reduced to 0.3-0.6 corresponding to 5-10 μm grains [5].

Acknowledgments: This research was completed thanks to the support of the Italian Space Agency (ASI), Grant ASI/Cassini I/031/05/0.

References: [1] Poulet, F., Cruikshank, D. P., Cuzzi, J. N., Roush, T. L., French, R. G. (2003), *Astronomy & Astrophysics, 412,* 305-316. [2] Filacchione, G., Capaccioni, F., McCord, T. B., Coradini, A., Cerroni, P., Bellucci, G., Formisano, V., Brown, R. H., Baines, K. H., Bibring, J. P., Buratti, B. J., Clark, R. N., Combes, M., Cruikshank, D. P., Drossart, P., Jaumann, R., Langevin, Y., Matson, D. L., Mennella, V., Nelson, R. M., Nicholson, P. D., Sicardy, B., Sotin, C., Hansen, G., Hibbitts, K., Showalter, M., Newman, S., D'Aversa, E. (2006), *Icarus, 186*, 259-290. [3] Nicholson, P. D., Hedman, M. M., Clark, R. N., Showalter, M., R., Cruikshank, D. P., Cuzzi, J. N., Filacchione, G., Capaccioni, F., Cerroni, P., Sicardy, B., Drossart, P., Brown, R. H., Buratti, B., Baines, K., Coradini, A. (2007) submitted to Icarus. [4] Filacchione, G. (2006), *Ph.D. Thesis*, ftp.iasf-roma.inaf.it/gianrico/tesi_phd/Filacchione_PHD_2006.pdf. [5] Poulet, F., Cuzzi, J. N., French, R. G., Dones, L. (2002) *Icarus 158*, 224-248.

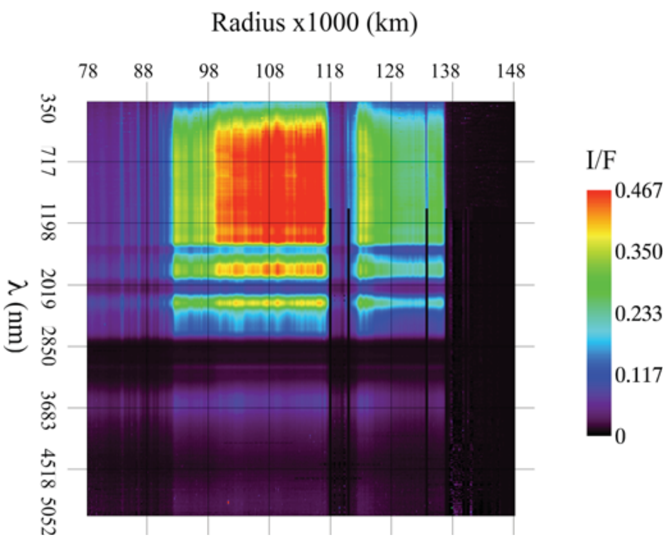

Fig. 1 Spectrogram (radius vs. wavelength) of the VIS-IR reflectance of the main rings of Saturn. Spatial sampling at 200 km/pixel resolution. Radial structure: C ring (R_S <92.000 km); B ring (92.000<R_S<117.000 km); Cassini division (117.000<R_S<122.000 km); A ring (122.000<R_S< 136.000 km). The water ice bands at 1500, 2050, 3000 and 4500 nm are present across the whole ring system; the faint fresnel peak is placed at 3098 nm.

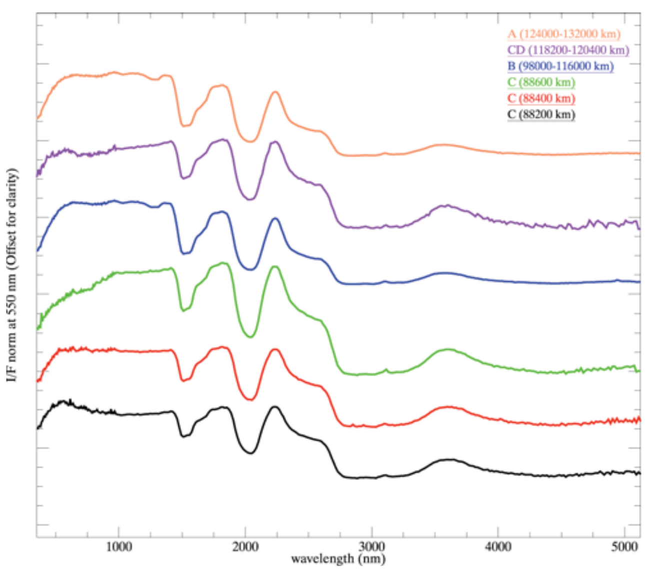

Fig. 2. VIS-IR reflectance spectra (normalized at 550 nm and stacked with an offset) of a C ringlet near 88.400 km and adjacent regions, B and A main rings and Cassini division.

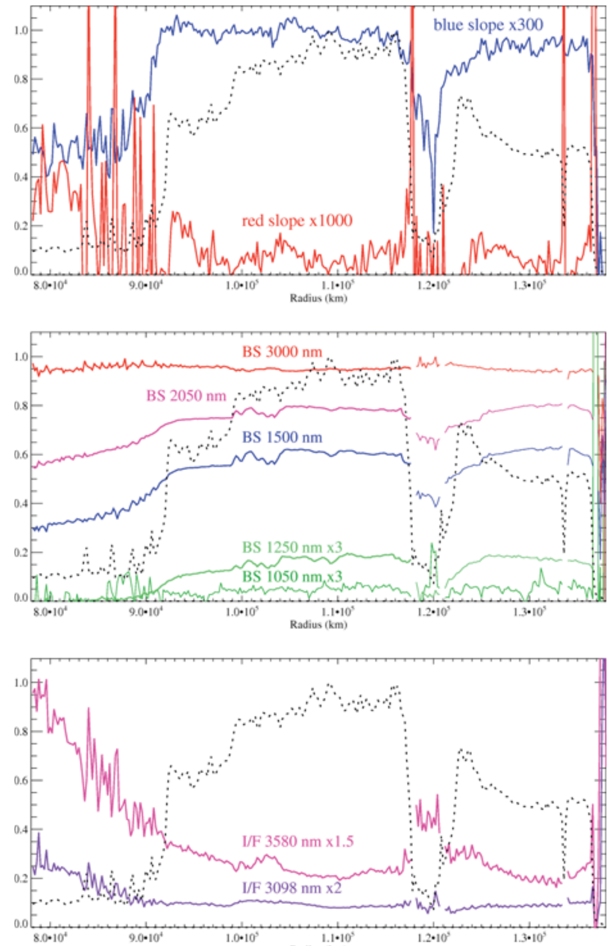

Fig. 3. Radial profiles. Top panel: visible blue and red slopes. Center panel: Water ice band strengths at 1050, 1250, 1500, 2050, 3000 nm. Bottom panel: reflectances at 3098 nm (water ice fresnel peak) and 3580 nm (indicator of grain size). Spatial sampling at 200 km/pixel resolution. The dotted line shown on all plots corresponds to the 550 nm radial profile normalized to maximum.