Far-ultraviolet photometric characteristics of Tethys, Dione and Mimas. E. M. Royer[1] and A. R. Hendrix[2], [1] Jet Propulsion Laboratory/California Institute of Technology, 4800 Oak Grove Dr., MS 230-205, Pasadena, CA 91109, USA (Emilie.M.Royer@jpl.nasa,gov), [2] Planetary Science Institute, 1700 East Fort Lowell, Suite 106, Tucson, AZ 85719-2395

Introduction: The icy moons of Saturn orbiting inside the E-ring experience weathering processes: E-ring grains as well as cold plasma ions, neutrals and energetic particles impact their surfaces. The Cassini UVIS instrument (UltraViolet Imaging Spectrograph), operating in the FUV wavelengths (118 – 190nm) probes the uppermost layers of the regolith and is uniquely suited to studying these exogenic processes, leading to a better understanding of the surfaces' evolution and the saturnian environment.

We present an analysis of ultraviolet disk-integrated phase curves of Tethys, Dione and Mimas. We model their leading and trailing hemispheres using a Hapke model to retrieve the photometric parameters of these surfaces, such as the single scattering parameters, the opposition effect parameters (where possible) and information on the roughness (where possible as well). The photometric behavior of Tethys and Dione is compared and contrasted with that of Mimas, and implications for the exogenic processes affecting the surfaces are discussed.

Observations: UVIS observes at wavelengths comprised between 111.5 nm and 191.2 nm in the FUV region and is sensitive to very small grains and surfaces processes. The detector format is 1024 spectral pixels by 64 spatial pixels. We analyzed disk-integrated observations, which means that the satellite is smaller than the pixel size in the field of view. At low-resolution, it subtends an angle of 1.5 mrad. A complete describtion ot the instrument is given by [1].

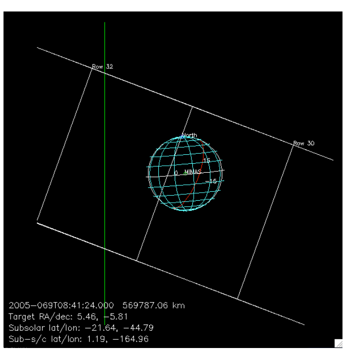

Figure 1. Disk-integrated observation of Mimas. The white lines (rectangles) delimitate the pixel size in the field of view.

Methods: We concentrate here on Mimas, Tethys and Dione, located in two diffrente regions of the E ring. Mimas rotates around Saturn in the inner part of the Enceladus orbit. Tethys and Dione orbit at further distance than Enceladus. This lattest is known as to be the source of the E ring particles [2].

We utilize a Hapke model [3] based on the presence of a shadow-hiding opposition effect (SHOE) and no coherent back-sctattering. The single scattering function is modelized by a double Henyey-Greenstein function. A quite large phase angle coverage is available for the three moons. Nevertheless an ideal modelisation requiert a full phase angle coverage from 0 to 180 degrees. Low phase angles are used to define the opposition effect parameters, such as the amplitude of the SHOE and its width. Large phase angles help to define the macroscopic roughness of the surface. The single scattering albedo and the phase function are defined by intermediaire phase angles.

Results: As expected, we find that the leading hemisphere of Tethys and Dione is brighter than their trailing side and at large phase angles, it seems that we directly observe these E-ring grains in forward scattering on both satellites.

On the contrary, Mimas has a trailing hemisphere brighter than its leading due to the orbial eccentricities of the E-ring grains overtaked Mimas in its orbit [4],[5].

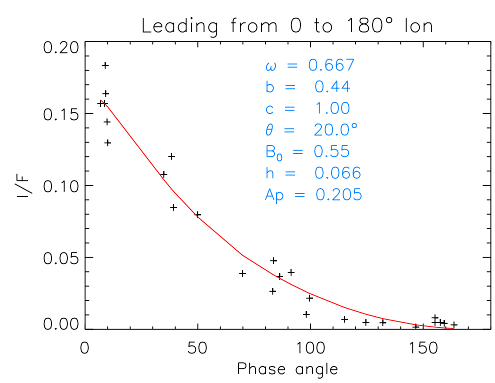

Figure 2. Phase curve of the leading hemisphere of Tethys. The black cross are the data points. The red line reprensents the Hapke model's best fit.

When writing this abstract, results concerning Mimas are in progress. Phase curve analysis for Tethys shows that its both hemispheres are forward-scaterring. Dione's central leading hemisphere (45 – 135 degress) is also forward-scattering, while its complete leading hemisphere (0 – 180 degress) is back-sacttering, as its trailing hemisphere.

The analysis of the opposition effect parameters suggests that bombardment by E –ring grains dominates on Tethys compared to Dione, consistent with Tethys orbiting in a region with a higher density of E-ring grains.

Both satellites have a stronger geometric albedo on their leading side, consistent with a brightening effect create by the impact of E-ring grains.

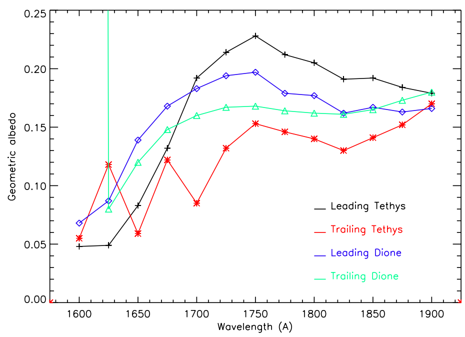

Figure 3. Gemetric albedo of the leading and trailing hemispheres of Tethys and Dione along the 160 – 190 nm wavelength range.

Conclusion: Photometric properties of the surfaces of icy satellites are affected by exogenic processes. Tethys and Dione are located in the E ring of Saturn and their leading hemisphere are affected by E-ring grain bombardment, which is expected to decrease with the distance from Enceladus, as the E-ring density diminishes. Tethys has a brighter leading hemisphere than Dione in the FUV, consistent with this hypothesis.

Compare photometrics properties of the surfaces of Tethys and Dione to those on Mimas will bring key answers about the dynamic of the E-ring grains and their weathering effects on the icy surfaces.

References: [1] Esposito, L. W. et al. (2004) *Space Sci. Rev.* 115, 299-361. [2] Porco, C. C. et al. (2006) *Science* 311, 1393-1401. [3] Hapke B. (2012) *Cambridge University Press*. [4] Hamilton, D. P. and Burns, J. A. (1994) *Science* 267, 550-553. [5] Buratti, B. J. (1990) *Icarus* 87, 339-357.