**FAR-UV SPECTRAL VARIATIONS ON THE ICY SATURNIAN MOONS.** Amanda R. Hendrix\(^1\), Candice J. Hansen\(^1\), Emilie M. Royer\(^2\). \(^1\)Planetary Science Institute, Tucson, AZ (arh@psi.edu), \(^2\)University of Colorado, Boulder, CO.

**Introduction:** During the Cassini mission at Saturn, the Ultraviolet Imaging Spectrograph (UVIS) made numerous observations of the icy moons Mimas, Enceladus, Tethys, Dione and Rhea to study surface composition and search for signs of activity. UVIS is sensitive to the uppermost portion of the regoliths of these moons, where interactions with E-ring grains, photolysis and plasma processing are important. We use the highest-resolution UVIS observations of these moons to look at regional spectral variations that could indicate effects of exogenic processes.

Though \(~99\%\) of the E ring grains are dominated by water ice, some 20-25\% of these grains contain organics [1]; the overall estimate of organics in the E ring is \(~0.5\%\%.\) Roughly 10\% of the E ring grains are salt-rich; the salt abundance in the E-ring is estimated to be around 0.15 to 0.3\% [1][2][3]. These non-ice species are transported to the surfaces of the satellites orbiting Saturn within the E ring and could act as coloring agents to the surfaces [4]. Plasma bombardment on the trailing hemispheres of the satellites and on the E ring grains can further process these organic and salt-rich species ([4][5]). At Enceladus, plume material is deposited on regions of the surface. UVIS observations can be utilized to study compositional variations that result from these processes; much of the signature observed by UVIS is related to H\(_2\)O ice (Fig. 1), which exhibits a strong absorption in the UVIS FUV range.

**Instrument and Datasets:** The Cassini UVIS [6] uses two-dimensional photon-counting and -locating detectors to provide simultaneous spectral and one-dimensional spatial images. The second spatial dimension is acquired by slewing the UVIS slit across the target body. The far-UV channel of UVIS covers a wavelength range of 114–190 nm. The detector format is 1024 spectral pixels by 64 spatial pixels. Each spatial pixel subtends an angle of 1 mrad projected on the sky. Of the three selectable slit positions available, most observations reported here were conducted with a spectral resolution of 0.275 nm subtending an angle of 0.75 mrad. We focus on the highest-resolution UVIS datasets, where the entire slit was on the body, or at least several spatial pixels were filled.

**Goals:** In this analysis, we derive disk-resolved photometric corrections for use with each datasets. In the simplest case, we can use a Lommel-Seeliger correction \((\mu_0/(\mu + \mu_0))\) to look at regional albedo variations (not for direct comparisons with images made at different phase angles). We can also derive Hapke photometric models for each hemisphere and apply those corrections to derive normal albedo maps. Using such photometric corrections, we can look at regional spectra (e.g. Fig. 5), and make maps (e.g. Figs. 2-4) using different projections, and compare with published ISS [7] and VIMS [e.g. (8)] maps. For Enceladus, we look for albedo variations across the surface that could correspond with visible color variations [8][9], evidence of plume fall-out zones and regions where plume fall-out is not as heavy (and where E ring grain bombardment dominates).

The study of compositional and photometric variations across regions on these icy moons will help us begin to understand: 1) the abundance and composition of non-ice materials; 2) H\(_2\)O ice grain size variations; 3) effects of exogenic processes, in particular E ring bombardment (and associated organics/salts) and plasma bombardment.

![Figure 1. FUV spectral reflectance model of H\(_2\)O.](image)

![Figure 2. In this sample Dione image (~180 nm, 10° phase angle, centered on 0°W, the sub-Saturnian hemisphere), we photometrically corrected the reflectance by dividing by the Lommel-Seeliger term (\(\mu_0/(\mu + \mu_0)\).](image)
Toward the right side of the image, the blue regions correspond to dark trailing hemisphere terrain, cross-cut by bright (green) wispy terrain.

**Figure 3.** In this sample Rhea image (~180 nm, 35° phase angle, centered on the anti-Saturnian hemisphere), we photometrically corrected the reflectance by dividing by the Lommel-Seeliger term \((\mu_0/\mu+\mu_0)\). Inktomi crater appears as a bright patch on the right limb. The anti-Saturnian region may be relatively bright compared to the trailing and leading regions.

**Figure 4.** In this sample Tethys image (~180 nm, 21° phase angle, centered on the sub-Saturnian hemisphere), we photometrically corrected the reflectance by dividing by the Lommel-Seeliger term \((\mu_0/\mu+\mu_0)\). Large-scale brightness variations are seen.

**Figure 5.** In this sample Rhea observation that covered two positions centered on the anti-Saturnian hemisphere (~180°W), we have derived two reflectance spectra by averaging the signal from the on-body pixels in each position. We used a simple photometric correction of dividing by average \(\mu_0\) for each position, where \(\mu_0\) is the cosine of the solar incidence angle. We find that the two reflectance spectra are quite similar and generally appear consistent with \(\text{H}_2\text{O}\) ice plus a non-ice component.