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Saturn's Icy Satellites as Measured by Cassini UVIS

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Nearly all of the major icy satellites of Saturn have now been observed by the Cassini Ultraviolet Imaging Spectrograph (UVIS). After practically one year in orbit around Saturn, we present UV results from these icy moons. The satellites of the Saturn system exhibit a remarkable amount of variability. From dark, battered Phoebe orbiting at 215 Rs to black-and-white Iapetus, the wispy streaks of Dione, heavily cratered Tethys and Mimas, to potentially geologically active Enceladus, the extent of geological phenomena displayed by these bodies is tremendous. Phoebe, Iapetus and Hyperion all orbit outside Saturn's magnetosphere, while Mimas, Enceladus, Dione, Tethys and Rhea all orbit within the magnetosphere. Furthermore, Mimas, Enceladus, Tethys and Dione all orbit within the E-ring – so the extent of exogenic effects of these icy satellites is wide-ranging. We expect that the UV signatures of these icy satellites are strongly influenced not only by their composition and water ice grain size, but by external effects and magnetospheric environments. The Cassini UVIS uses two-dimensional COCACON detectors to provide simultaneous spectral and one-dimensional spatial images. Two spectrographic channels provide images and spectra in the EUV (563-1182 Å) and FUV (1115-1912Å) ranges. In this analysis, we focus on the data from the FUV channel. In the FUV, water ice is characterized by a very strong absorption feature at ~160 nm. At wavelengths shorter than ~160 nm, water ice is extremely dark and spectrally gray. The water ice absorption feature dominates the FUV spectra of nearly all regions of the icy satellites. Spectral differences exist among the icy satellites that reveal compositional and water ice grain size variations. Additional effects on the spectral behavior of the satellite are from magnetospheric bombardment, meteoritic bombardment and potential endogenic material similar to carbonaceous chondrites (dark, red material). All of these satellites (with the exception of Phoebe) are tidally locked, so that one hemisphere faces Saturn at all times. The relative velocities between the E-ring particles and the icy satellites may explain the large-scale longitudinal albedo patterns on the icy satellites that are seen at visible-near IR wavelengths. Mimas and Enceladus are both slightly darker on the leading hemispheres than on the trailing hemispheres at visible wavelengths, possibly because the E-ring particles sweep by the trailing hemispheres, brightening them. Conversely, the leading hemispheres of Tethys and Dione are brighter than the trailing hemispheres, because their leading hemispheres sweep by the E-ring particles. We investigate the UVIS data to see if such a pattern holds up in the FUV, and whether associated grain size variations are detected.