IAPETUS AND PHOEBE AS MEASURED BY THE CASSINI UVIS. A. R. Hendrix[1] and C. J. Hansen[1], [1]Jet Propulsion Laboratory/California Institute of Technology, 4800 Oak Grove Dr., MS 230-250, Pasadena, CA, 91109, hendrix@jpl.nasa.gov.

Introduction: The bizarre appearance of Iapetus has long intrigued researchers of this Saturnian moon. The leading hemisphere is very dark and reddish in color at visible-near-IR wavelengths. In contrast, the trailing hemisphere is relatively bright and its near-IR spectrum is dominated by water ice [1]. The severe hemispherical brightness dichotomy has been explained by both endogenic and exogenic models. The primary endogenic model involves eruption of dark material onto the leading hemisphere from the interior of Iapetus [2]. Exogenic models include exposure of dark underlying material by micrometeorite bombardment [3], contamination of Iapetus' leading hemisphere by Titan tholin material [4], and the coating of the leading hemisphere by Phoebe dust [5]. It has been shown [6] that the dark material on Iapetus' leading hemisphere is redder in color at visible wavelengths than Phoebe, which is spectrally gray at visible wavelengths. An additional exogenic model [6] involves the coating of both Iapetus' leading hemisphere and Hyperion with material from small retrograde satellites, which are reddish in color at visible wavelengths. We present the first FUV spectra of Iapetus and Phoebe to investigate whether the UV wavelength range can contribute to solving the puzzle of Iapetus.

UVIS: The Cassini Ultraviolet Imaging Spectrograph (UVIS) [7] uses two-dimensional CODACON detectors to provide simultaneous spectral and one-dimensional spatial images. Two spectrographic channels provide images and spectra in the EUV (563-1182Å) and FUV (1115-1912Å) ranges. The detector format is 1024 spectral pixels by 64 spatial pixels. Each spectral pixel is 0.25 mrad and each spatial pixel is 1 mrad projected on the sky. The UVIS has three selectable slits. The high-resolution slit is 0.75 mrad wide for the FUV channel (1.0 mrad for the EUV channel), the low-resolution slit is 1.5 mrad wide for the FUV channel (2.0 mrad wide for the EUV channel) and the occultation slit is 8.0 mrad wide for both the FUV and EUV channels. The high- and low-resolution slits have spectral widths of 2.75Å and 4.8Å, respectively, in both the FUV and EUV channels.

Observations: We present results from Cassini's December 31, 2004 flyby of Iapetus and the June 11, 2004 flyby of Phoebe. The range to Phoebe (radius=107 km) at closest-approach was 2068 km, while the Iapetus (radius~730 km) closest-approach distance was 124,000 km. Both flybys had illuminated approaches: the inbound phase angle at Phoebe was ~90° with a closest-approach phase angle of ~25° while the inbound phase angle at Iapetus was ~30° and increased throughout the flyby to ~150°. The Iapetus observations focused on the dark leading hemisphere, but bright terrain, particularly in the north polar region, was also visible.

Results: 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 shortward of ~160 nm, water ice is extremely dark and spectrally gray. As shown in Figure 1, the water ice absorption feature dominates the spectra of Phoebe and the spectra of the bright terrain on Iapetus. The dark material on the leading hemisphere of Iapetus is extremely dark at FUV wavelengths and displays only a hint of the signature water ice absorption. Additionally, compositional variations are detected across the surface of Phoebe: the lower latitudes are darker and contain more non-ice material than the polar regions, which are richer in pure water ice.

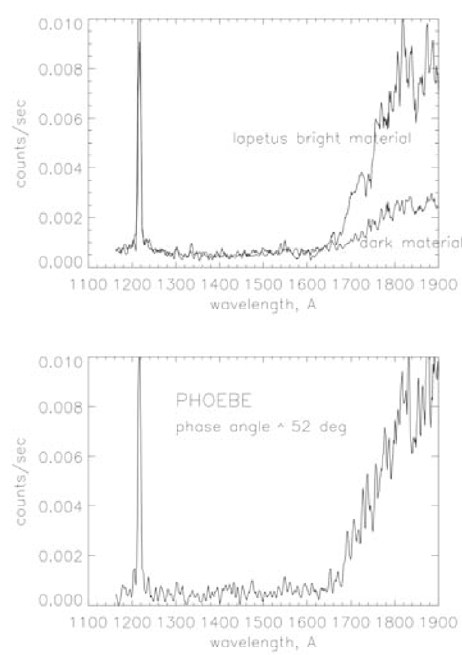

Fig. 1 (upper) FUV spectra of Iapetus bright and dark material. The phase angle for both observations is ~54°. (lower) Phoebe spectrum at similar phase angle as Iapetus data.

Interpretation: We model the spectra of Phoebe and Iapetus using water ice and non-ice materials to understand the composition of the surfaces as measured in the UV. We compare spectra and model results from Phoebe and the dark material on Iapetus to understand whether the leading hemisphere of Iapetus could be contaminated with Phoebe material. Clearly (Fig. 1) Phoebe and Iapetus' dark material are spectrally different in the FUV wavelength range; we explore the reasons why this is so. One possibility is simply that the leading hemisphere of Iapetus is not coated with material from Phoebe. We will investigate whether the material that contributes to Phoebe's darkness is the same material that makes the leading hemisphere of Iapetus so dark; if they are different, this is a strong suggestion that Phoebe material does not coat the leading hemisphere of Iapetus. Another possibility is that Phoebe material coats the leading hemisphere of Iapetus, but during the impact process most of the volatiles are lost [5]. Iapetus' dark material is much darker than Phoebe's spectrum – if this spectral difference is due to a much larger amount of water ice on Phoebe than on the leading hemisphere of Iapetus, this suggests the possibility that if Phoebe material coats Iapetus, it must have lost much of its water in the impact process. If so, this is a UV case for an exogenic source of the dark material on the leading hemisphere of Iapetus.

References: [1] Clark, R. *et al.* (1984) *Icarus, 58*, 265. [2] Smith *et al.* (1982) *Science, 215*, 504. [3] Cook, A. F. and Franklin, F. A. (1970) *Icarus, 13*, 282. [4] Owen, T. *et al.* (2001) *Icarus, 149*, 160. [5] Cruikshank, D. *et al.* (1983) *Icarus, 53*, 90. [6] Buratti, B. *et al.* (2002) *Icarus, 155*, 375. [7] Esposito, L. *et al.* (2004) *Space Sci. Rev*.