RESOLVED ULTRAVIOLET TO INFRARED REFLECTANCE SPECTROSCOPY OF MERCURY FROM THE SECOND MESSENGER FLYBY. Noam R. Izenberg[1], William E. McClintock[2], Gregory M. Holsclaw[2], David T. Blewett[1], Jörn Helbert[3], Sean C. Solomon[4] and the MESSENGER Team. [1]Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD, 20723, USA (noam.izenberg@jhuapl.edu); [2]Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, 80303, USA; [3] Institute for Planetary Research, DLR, 12489 Berlin, Germany; [4]Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC 20015, USA.

Introduction: The MESSENGER spacecraft flew by Mercury on January 14 and October 6, 2008, as part of its journey to Mercury orbit insertion. The Mercury Atmospheric and Surface Composition Spectrometer (MASCS) [1] conducted exosphere and surface observations during both flybys, including high-spatial-and-spectral-resolution visible to near-infrared (IR) spectra of the Mercury surface. The Visible and InfraRed Spectrograph (VIRS) component of MASCS consists of two linear photodiode arrays covering a spectral range 320-1450 nm. The UVVS component consists of three photomultiplier tubes and a scanning grating, covering spectral emissions and reflectance over the range 115-600 nm. We discuss the MASCS UV to IR surface reflectance observations for the second Mercury flyby and their application to the mineralogical investigation of Mercury's composition [2].

UV to IR Reflectance Measurements: Fig. 1 shows the ground track of the MASCS instrument boresight across a composite MESSENGER map of Mercury. VIRS began acquiring spectra before crossing the terminator and continued along a near-equatorial track accumulating 1-s exposures (with an overhead gap of 0.25 s) until shortly after the boresight left the limb of the planet. Approximately 380 visible to near-IR spectra were taken across the surface, near the equator from about -90° to 0° E longitude. The majority of the ground track crossed regions of Mercury imaged by Mariner 10. Most of the MASCS VIRS spectra were contemporaneous with high-resolution color image sets taken by MESSENGER's Mercury Dual Imaging System (MDIS) Wide Angle Camera (WAC). The Narrow Angle Imager (NAC) covered the MASCS ground track subsequently with high-spatial-resolution monochrome imagery [3]. Mercury surface reflectance varied with geography and geology and correlated well with color units identified by MDIS (Fig. 2) [4].

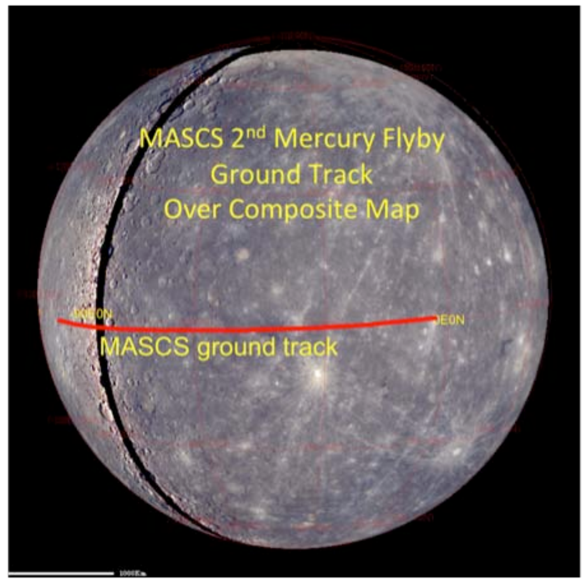

Figure 1. MASCS ground track over MDIS composite map of Mercury.

MASCS UVVS acquired six complete and one partial middle-UV (220-300 nm) spectra along the ground track. Due to the nature of the ground track and scanning grating, observations at individual UV wavelengths were spread over a wide surface area, and additional corrections for topography and shading were needed for initial analysis (Fig. 3). Moreover, one complete and one partial far-UV (115-200 nm) surface spectra were acquired, resulting in MESSENGER's first detection of surface reflected Lyman-α.

Ongoing spectral analyses, including photometric corrections [5], principal component analysis, [6] and comparisons of flyby 2 observations to flyby 1 and previous telescopic observations of Mercury, will improve our ability to tie these observations to inferences on surface units and their characteristics.

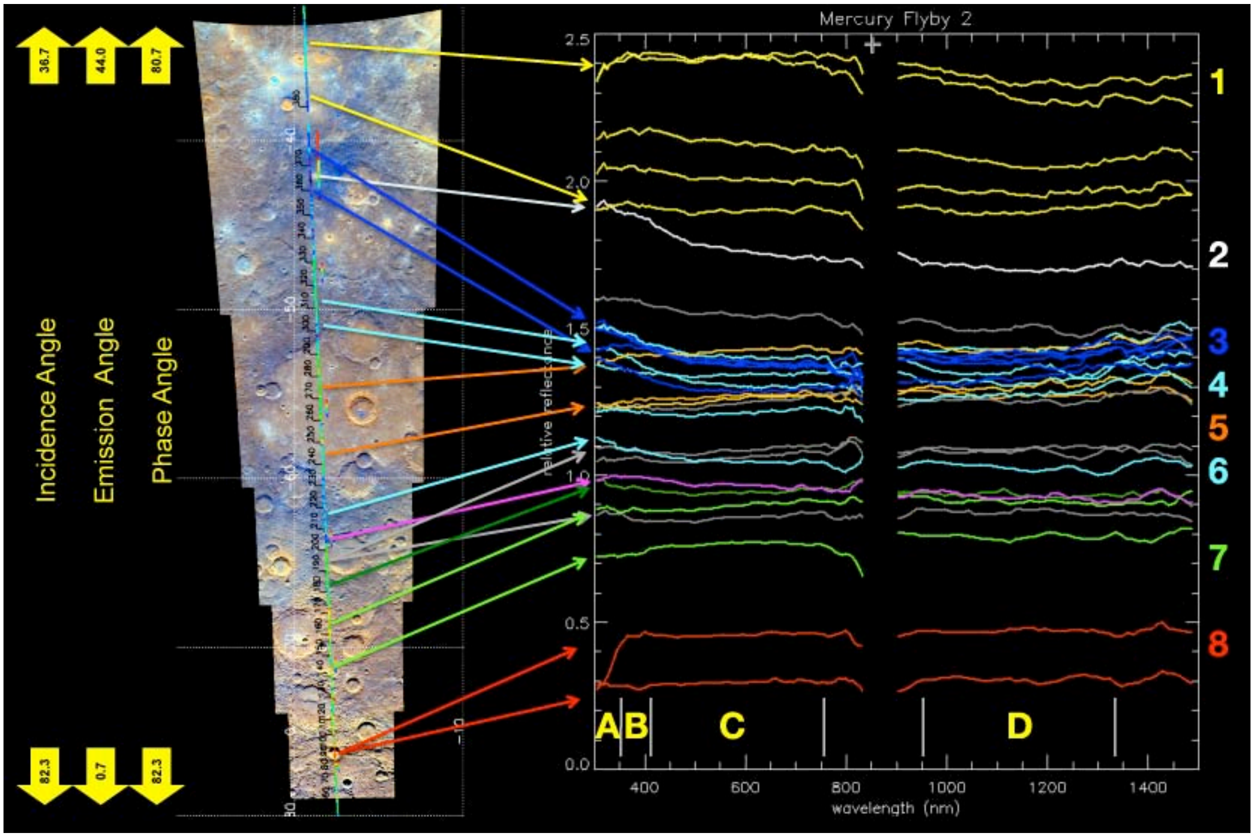

Figure 2. MASCS spectral reflectance at selected locations from MESSENGER's Mercury flyby 2. The near-equatorial MASCS VIRS track is shown overlaid on an MDIS color composite, and rotated 90° counterclockwise for matching with extracted spectra. Calibrated near-UV to IR spectra are normalized relative to an average flyby 2 reflectance spectrum. Brightness differences due to Sun angle are uncorrected. Geologic/color units are numbered: (1) "Orange" materials; (2) Small bright crater in Low-Reflectance Material (LRM); (3) LRM; (4,6) Rudaki annulus; (5) Rudaki Planitia interior; (7) Plains units and crater walls at high Sun angle; (8) Small crater floor and wall. Spectral regions of interest are lettered: (A) Near-UV variation – possible charge transfer (Fe, Ti) bands; (B) 350–410 nm: Some of the greatest spectral variation, similar to Mercury Flyby 1 [1]; (C) VIS to nearest-IR relative slope changes, corresponding with MDIS color units; (D) No characteristic 1-μm band due to FeO in silicates observed, but possible band-like feature and variation at 1.1-1.2 μm, similar to telescopic observations [7].

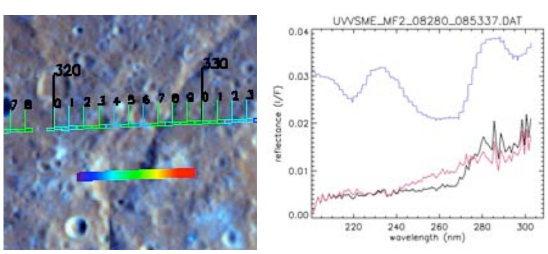

Figure 3. Using MDIS albedo to remove topographic and shadow features to compensate for spatial spread of MASCS UVVS ground spectra (220-300 nm) [8].

References: [1] W. E. McClintock and M. R. Lankton (2007) *Space Sci. Rev. 131*, 481-522; [2] B. W. Denevi et al., (2009) *LPSC XL*, this meeting; [3] N. L. Chabot et al., (2008) *EOS Trans, AGU 89(53)*, Fall Meet. Suppl., U21A-0014; [4] M. S. Robinson et al., 2008 *Science 321*, 66-69; [5] D. L. Domingue et al., LPS XL, this meeting; [6] J. Helbert et al., (2009) *LPSC XL*, this meeting; [7] J. Warell et al. (2006), *Icarus 180*, 281-291; [8] G. M. Holsclaw et al., (2008) *EOS Trans, AGU 89(53)*, Fall Meet. Suppl., U21A-0024.