COMPARISON OF EUV REFLECTANCE SPECTRA FROM MERCURY AND THE MOON

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I. Introduction. Carbon, as graphite, emerged from analyses of Mercury MESSENGER spectrophotometry and theoretical modeling as a possible source for the darkening component in the Low Reflectance Material (LRM), pervasive across Mercury's equatorial surface. Based on the presence of a 600-nm absorption in the Mercury Dual Imaging System (MDIS) photometry, graphite in amounts consistent with the results from MESSENGER's elemental experiments for the presence of C, was proposed as the most likely darkening component in LRM [1]. Two general theories about the origin of the carbon have been proposed. In one scenario, graphite would be the only buoyant phase in an early magma ocean, and any primary flotation crust would have retained C in the form of graphite [2]. Considering external origins, however, carbon from cometary sources has been proposed to be the darkening material [3]. Alternatively, nanophase and microphase iron (rather than C), produced by impacts into Mercury's crust before and during the late heavy bombardment, could darken the LRM [4]. The global concentration and distribution of carbon on Mercury's surface have been examined (e.g., [5]). Carbon, in the forms of graphite and anthracite, has distinctive far-UV spectral reflectance features [Fig. 1] [6]. The MESSENGER Mercury Atmospheric and Surface Composition Spectrometer (MASCS) Ultraviolet and Visible Spectrometer (UVVS) did not extend to wavelengths low enough to observe these features. We are re-analyzing Mariner 10 Extreme Ultraviolet (EUV) airglow spectrometer data in a search for this distinctive UV signature of graphite/anthracite across large areas of Mercury's surface.

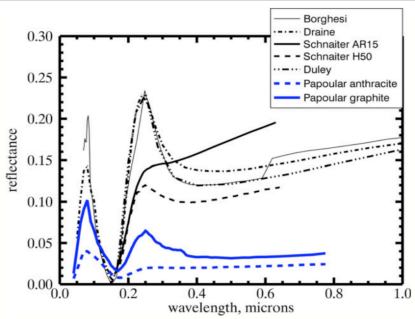

Fig. 1. Spectral reflectance models of particulate graphites and anthracites based on published optical constants. Grains of 5-µm diameter are assumed. From [6], and references therein.

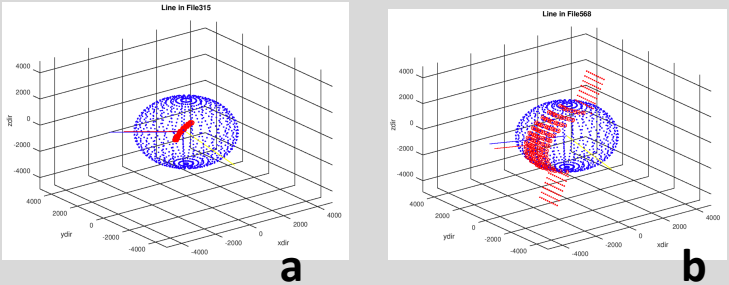

Fig. 2. Sample M10 UVS geometric slit plots: a) slit projection contained on Mercury's surface; b) projection extends past the surface. Blue line points to spacecraft; red line to instrument boresight; yellow line to the sun. The software can rotate the planet display.

II. Study Approach. The Mariner 10 EUV airglow spectrometer observed broad swaths of Mercury's surface during Fly-bys 1 (29 Mar 1974) and 3 (16 Mar 1975). The same side of the planet was always observed, and ~45% of the planet's surface was imaged. One observation set includes counts through 10 filters at the wavelengths 304, 430, 580, 740, 869, 1048, 1216, 1304, 1480, 1659 Å, each having 20Å passbands. A slit cutting across the disk in one direction was stepped across the visible portion of the planet's disk. We have uncovered ~800 individual sets of photometry covering all or part of Mercury's surface. Figs. 2 and 3 show examples of the slit entirely on the surface and partly on the surface. Our immediate next steps are twofold: First, for each observation, we project the slits onto the MESSENGER high-resolution global image of Mercury, to make images of what surface area the slit covered during the observation. Second, for each observation, we produce I/F values in each filter.

10 SEC SUMMARY:
WE HAVE MADE SIGNIFICANT PROGRESS RECOVERING MARINER 10 UVS DATA OF MERCURY'S SURFACE TAKEN DURING MARINER 10 FLY-BYS 1 AND 3. NOT DONE YET, THOUGH. SO NO COMPARISON WITH THE MOON (YET).

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