THE REFRACTIVE INDEX OF THE REGOLITH OF MERCURY; B. Hapke, Univ. of Pittsburgh.

The real parts of the average refractive indices of the regoliths of the Moon and Mercury in visible light can be estimated from the second Stokes vector using the method proposed in [1]. This method assumes that in the phase angle range between 30 and 70 degrees, all light internally scattered within regolith particles or multiply scattered between them is randomly polarized, so that the only contribution to the difference between absolute radiances polarized perpendicular and parallel to the scattering plane is Fresnel reflection from the grain surfaces. For dielectrics the angular Fresnel reflection coefficients depend only on the real part n of the index of refraction.

The analysis was carried out for two samples of Apollo fines and for integrated light from the Moon and Mercury. Laboratory measurements were used for the Lunar samples. For the Moon, polarization measurements [2,3] were combined with absolute photometric data [4,5] to deduce absolute polarized radiances. Similarly, polarization [2,6,7,8] and photometry [9,10, 11] were combined for Mercury.

The results of the analyses are given in table 1, along with typical values of n [12] for the most abundant minerals in the Lunar regolith. For the Moon the analysis gives n = 1.78±.03, in good agreement with the Apollo samples and with values expected from Lunar mineralogy. For Mercury the analysis gives n = 2.07±.08, significantly higher than the Lunar value. A possible reason for the larger n is the presence in the Mercurian regolith of metallic iron particles larger than the wavelength.

Because this technique has only been tested on a limited number of materials [1, 13], its general applicability has not yet been established. However, there may be significant compositional differences between the surfaces of Mercury and the Moon. This further demonstrates the importance of renewing the exploration of Mercury by spacecraft, such as the proposed Discovery-class Hermes Mercury Orbiter Mission.

Table 1. Real Refractive Indices

Object	n
Anorthite	1.6 - 1.8
Pyroxene	1.6 - 1.8
Olivine	1.6 - 1.9
Ilmenite	~ 2.7
Apollo 10084	1.68±.05
Apollo 12070	1.67±.04
Integrated Moon	1.78±.03
Integrated Mercury	2.07±.08

Refractive Index of Mercury; B. Hapke

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