EARLY RESULTS FROM THE PLANETARY SURFACE TEXTURE LAB: POLARIMETRY AND PHOTOMETRY OF JSC-1A LUNAR SIMULANT

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Introduction: The Planetary Surface Texture Laboratory (PSTL) provides a unique opportunity to characterize the photometric and polarimetric response of various planetary regolith analogs. The light scattered from a planetary surface can reveal information related to grain size, particle shape, porosity, and roughness. The data obtained with PSTL will be key for comparative analysis of surface texture; quantifying the response of regolith analogs can provide a framework for interpreting remotely sensed data.

Planetary Surface Texture Laboratory: PSTL is a new facility at the Johns Hopkins University Applied Physics Laboratory (APL) for exploring the phase and polarization response of planetary regolith analogs. The arc goniometer supports a light source, an imaging polarimeter, and a center sample stage. The imaging polarimeter obtains coregistered images of a scene at 0°, 90°, and 135° polarization. The light source and polarimeter have the capablility to move through a range of angles, controlled by a computer interface, to image samples at a variety of photometric geometries (illumination, viewing, and phase angles, where the phase angle is the angle subtended at the surface between the light source and camera).

Phase-Ratio Analysis: Phase-Ratio analysis utilizes the ratio of two coregistered images of the same surface that were collected at different phase angles. Phase-ratio analysis is becoming a widely used technique in planetary science, with recent reports describing spacecraft observations of the Moon, Mercury, Eros, and Vesta. Phase-ratio images reveal differences in the phase curve of materials in the scene. Phase-ratio analysis has been used to infer the presence of texture variations at locations including impact craters [1], lunar swirls [2], and spacecraft landing sites [e.g., 3].

Polarimetric Analysis: The Korea Pathfinder Lunar Orbiter (KPLO) is scheduled to launch this year. The Polarimetric Camera (PolCam) onboard KPLO will be the first instrument to obtain global polarization maps of the Moon [4]. Compared with techniques like reflectance or emittance spectroscopy, to date relatively few laboratory studies have explored the polarization behavior of planetary surface materials. The goal of PSTL is to bridge this gap in knowledge by collecting phase and polarization data for well-characterized planetary regolith analog materials.

Preliminary Results: We will present early PSTL results from a study of the JSC-1A lunar mare simulant. Work on preliminary polarization phase-curves (polarization parameters as a function of phase angle) and phase-ratio analysis is underway. The JSC-1A has been sieved to two different size fractions (< 63 μm and > 63 μm). The size separates are being characterized in terms of particle size and shape parameters using a Retsch Camsizer instrument.

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