PRELIMINARY PHOTOMETRIC MODELING OF THE CHANG'E-3 LANDING SITE USING THE VNIS OBSERVATIONS. Jiang Zhang[1], Zongcheng Ling[1] and Bo Li[1], [1]Institute of Space Sciences and Shandong Provincial Key Laboratory of Optical Astronomy & Solar-Terrestrial Environment, Shandong University (Weihai), Weihai, 264209, China (zhang_jiang@sdu.edu.cn).

Introduction: The VIS/NIR Imaging Spectrometer (VNIS) onboard the Chang'E-3 Yutu Rover obtained spectral observations for four sites (Fig. 1) around the landing site (44.12° E, 19.51° W) under a variety of illumination geometries (Fig. 2). Although resolved lunar photometric parameter maps had been produced from the Lunar Reconnaissance Orbiter Camera (LROC) data [1], rocket exhaust during the Chang'E-3 descent can alter the physical properties of the soils around the landing site, indicating that it is desirable to derive photometric parameters based on the VNIS data.

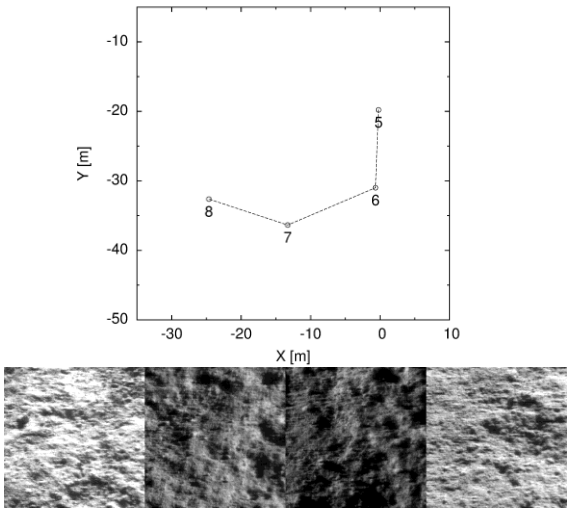

Figure 1: Four VNIS observation sites in the Chang'E-3 lander coordinate system and their images (VNIS 750 nm).

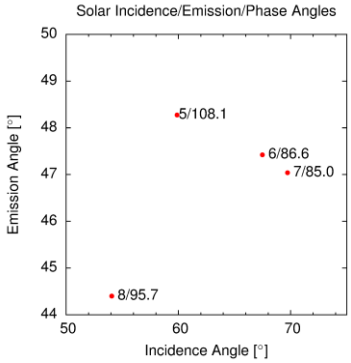

Figure 2: VNIS illumination geometries for the four observation sites as shown in Fig. 1.

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Data and Methods: The Chang'E-3 VNIS consists of two spectral portions: 1) VNIR, imaging, 400-950 nm, 100 bands; 2) SWIR, non-imaging, 900-2400 nm, 300 bands [3, 4]. The raw VNIS data were normalized at 1 AU Sun-Moon distance, and converted into reflectance as described in [3]. As the non-imaging SWIR spectra might cover areas with large solar phase angle range, the VNIS 750 nm images were used for our photometric study, and emission/phase angle for each pixel were calculated from those given for four corners and center points. Then these data were binned by incidence/emission/phase angles; the average and standard deviation for reflectance values within each angle bin were calculated (Fig. 3).

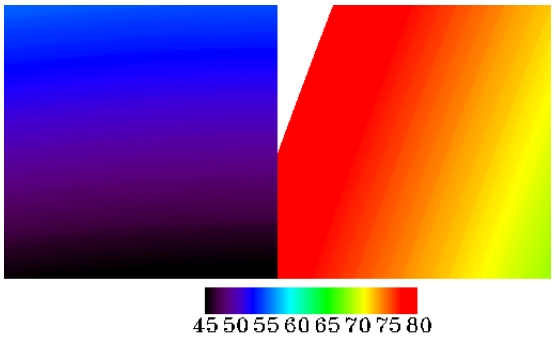

Figure 3: Emission and solar phase angles for the VNIS observation at Site 5 (Fig. 1)

A simplified Hapke model that contains only four free parameters is used in our preliminary photometric modeling [5]. As shown in Fig. 2, no VNIS data were measured at small phase angles, indicating that the opposition effect term in the Hapke model is not well constrained and a unique set of parameter values can not be derived using the Least Square Fitting. However, the parameter domain can be estimated as follows: 1) random points in the parameter space were generated using Monte Carlo method; 2) the points are accepted only if the modeled reflectance values produced at each angle bin lie within the range specified by the average values and their accompanied standard deviation mentioned above; 3) For each accepted point in the parameter space, those with minimum χ^2 values are kept for further study.

Results: Although possible photometric parameter values can be searched with the Chang'E-3 VNIS observations, a unique and complete Hapke model can only be derived when more constraints from other data (e.g., LROC) are considered, especially for the

opposition effect term. Future work will put the Apollo sample results [6] into our analysis.

References: [1] Sato H., et al. (2014) *JGR, 119*, 1775-1805. [2] Clegg R. N., et al. *LPSC XXXXV*, Abstract #1625. [3] Liu B., et al. (2014) *RAA, 14*, 1578-1594. [4] He Z., et al. (2014) *RSI, 85*, 083104. [5] Hapke B., et al. (2012) *JGR, 117*, E00H15. [6] Johnson J. R., et al. (2013) *Icarus, 223*, 383-406.

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