ON THE EQUATOR-POLE AND EAST-WEST PHOTOMETRIC ASYMMETRY OF THE LUNAR SLOPES. V. Korokhin[1], Y. Shkuratov[1], V. Kaydash[1], S. Velichko[1], G. Videen[2]; [1]Institute of Astronomy, V. N. Karazin Kharkiv National University, 35 Sumska Str., Kharkiv, 61022, Ukraine, [2]Space Science Institute, 4750 Walnut St. Suite 205, Boulder CO 80301, USA.

Introduction: Using spectral data from the SELENE spacecraft [1] and the Lunar Impact Crater Database 2015, Sim et al. [2] found that the optical properties of north, south, east, and west walls of craters vary systematically across the Moon. Pole-facing walls are brighter and less red, perhaps due to less mature regolith, than their equator-facing counterparts as latitude increases. This can be explained by reduced solar wind flux in pole-facing slopes. The SELENE data have been topography-corrected using the McEwen et al. [3] photometric function. There remains a question whether these effects are the result of an inaccurate photometric correction that is not trivial [4]? Using distributions of pure normal albedo may help to resolve the problem.

Equator-Pole asymmetry from LOLA data: The global albedo map of the Moon at 1064 nm from LOLA [5] gives such an opportunity to address this question. Moreover, LOLA provides us also high-quality topography data.

To study photometric asymmetry of the lunar surface slopes, we select albedo and topography data for 2 lunar zones: +40°...+60° on North and -60°...-40° on South. We construct correlation diagrams “A_0 vs. *Slp_Lat*” (latitudinal component of local slopes). Only pixels for which *Slp_Lat* > 6° and *Slp_Lat* > *Slp_Lon* are used for the analysis. We find 71924 points for Northern and 81263 points for Southern zones. We average the diagrams along the vertical axis and compensate for the global latitude slope (Figs. 1a, b). We find a clear asymmetry of the normal albedo depending on where the slope is facing, at the equator or the pole. Equator-facing slopes are regularly darker than pole-facing ones. This confirms the main conclusion of the Sim et al. [2] about the influence of insolation on the surface albedo. The dependence of albedo on slope value is observed: the greater the slope, the greater the albedo. This can be explained by more intensive renewal processes for larger surface slopes.

East-West asymmetry from LOLA data: Sim et al. [2] find that east-west differences in crater-wall brightness and color ratios vary with longitude, which they explain by solar wind shielding as the Moon passes through the Earth’s magnetosphere. We construct the diagram “A_0 vs. *Slp_Lon*” (Fig. 2) using a technique analogous to Fig. 1 to check this using LOLA data. We do not find the East-West asymmetry using LOLA data.

Equator-Pole and East-West asymmetry of albedo using LROC WAC data: There is one more dataset that is suitable for studying the asymmetry. These are global maps of the Empirically Normalized Reflectance (*ENR*) obtained from LROC WAC observations in several wavelengths [6]. Figure 3 demonstrates the dependence of the WAC *ENR* on the latitudinal component of the surface slope, which was constructed analogously to the LOLA data dependence at two wavelengths, 689 and 415 nm. The behavior of this dependence is qualitatively the same as for the LOLA case (Fig. 1a, b). Some difference can be due to the resolution distinction. Similar to the LOLA case, the East-West asymmetry of albedo is not detectable with the WAC *ENR* data.

Equator-Pole and East-West asymmetry of color ratio (689/415 nm) using LROC WAC data: The WAC *ENR* maps are in several wavelengths. Thus, there is an opportunity to study the spectral asymmetry of the lunar surface slopes. We have constructed the dependence of WAC *ENR* color ratio (689/415 nm) on the latitudinal and longitudinal components of the surface slope in Fig. 4a, b. Fig. 4a confirms the conclusion of Sim et al. [2] concerning the reddening of equator-facing slopes caused by more intense insolation. Fig. 4b demonstrates that the East-West asymmetry of color ratio (689/415 nm) is absent.

Conclusion: (1) Using an alternative method, we have confirmed the main conclusion of Sim et al. [2] that equator-facing slopes are regularly darker than pole-facing ones due to more intense insolation. (2) The use of the LOLA normal albedo completely excluded the assumption about the influence of photometric reduction of SELENE data on the results of [2]. (3) A dependence of albedo on slope is observed: the greater the slope, the higher the albedo. That can be explained by more intensive process of renewal of more inclined surface areas. (4) Using the WAC *ENR* maps, we have confirmed the conclusion of Sim et al. [2] about more reddening of equator-facing slopes caused by more intense insolation. (5) Both LOLA A_0 and WAC *ENR* data show that the East-West asymmetry of albedo A_0(1064.3 nm), *ENR*(689 nm) and color ratio *ENR*(689 nm)/*ENR*(415 nm) of the lunar surface slopes are not detectable.

References: [1] Ohtake et al., (2008) *Earth Planet. Space* 60, 257-264. [2] Sim et al., (2017) *GRL* 44, 11,273–11,281. [3] McEwen et al., (1998) *LPSC*-29, 1466. [4] Shkuratov et al., (2011) Planet. Space

Sci. 59, 1326-1371. [5] Lucey et al., (2014) *JGR Planets* 119, 1665–1679. [6] Boyd et al., (2012) *LPSC-43*, 2795.

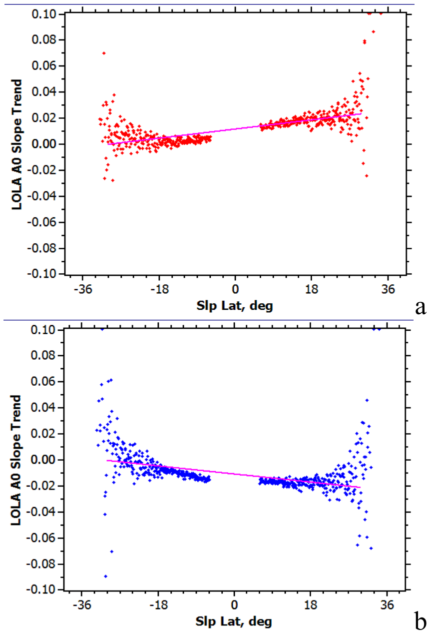

Figure 1. Dependence of LOLA A_0 on lat. slope with compensation for the global slope trend. (a) and (b) correspond to the northern (+40°...+60°) and southern (-60°...-40°) latitude zones.

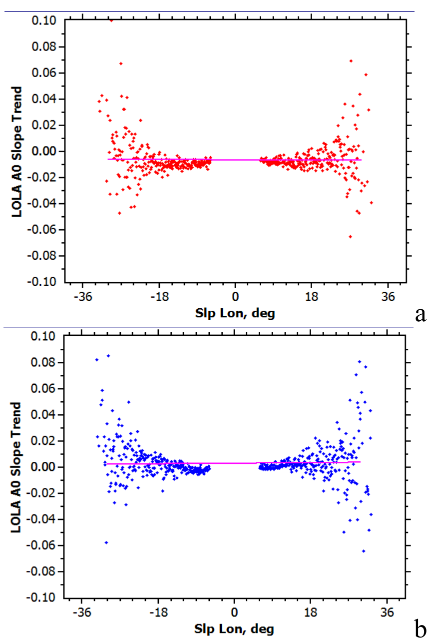

Figure 2. Dependence of LOLA albedo on lon. slope. with compensation for the global slope trend. (a) and (b) correspond to East (60°...90°) and West (270°...300°) limbs.

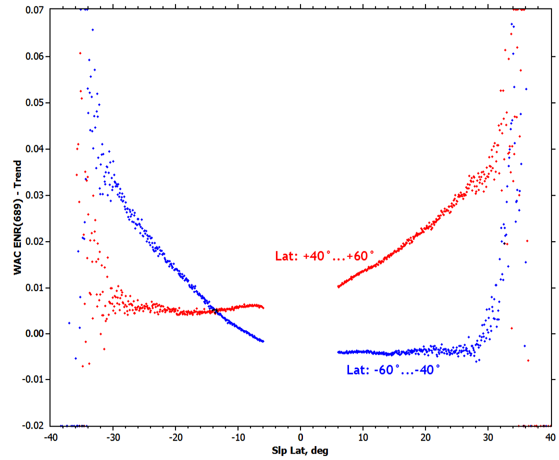

Figure 3. Dependence of WAC *ENR* (689 nm) on lat. slope with compensation for the global slope. Red and blue colors correspond to the northern (+40°...+60°) and southern (-60°...-40°) latitude zones.

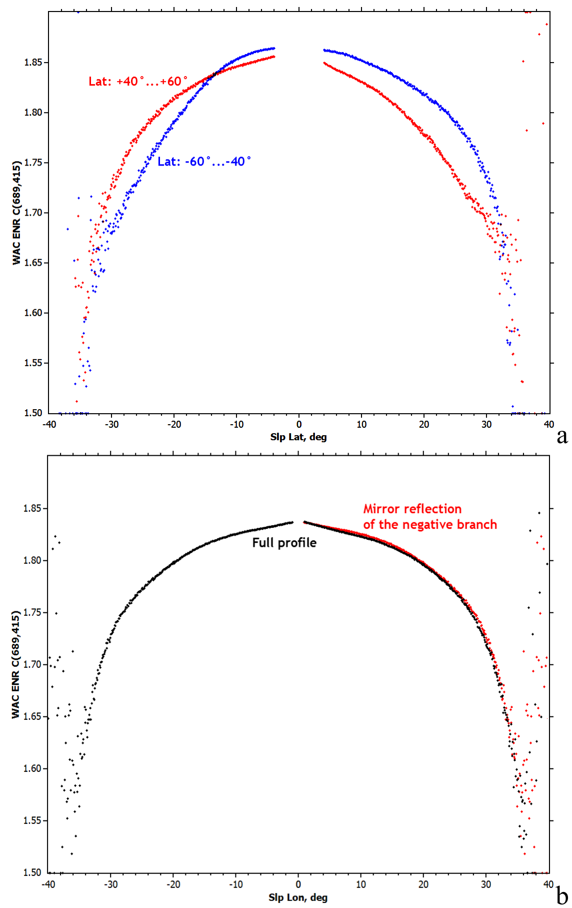

Figure 4. Dependence of WAC *ENR* color (689/415 nm) on lat. (a) and lon. slopes (b). The right branch in (b) includes also points (red color) from the left branch.