PHASE-RATIO AND PHASE DEPENDENCE OF ALBEDO OF IRREGULAR MARE PATCH MASKELYNE OBTAINED FROM LROC NAC DATA. S. Velichko, V. Korokhin, V. Kaydash, Y. Shkuratov, Institute of Astronomy of V.N.Karazin Kharkiv National University, Sumska 35, 61022 Kharkiv, Ukraine (sergvelichko.sv@gmail.com).

Introduction: One of the interesting geological formations on the Moon is Irregular Mare Patches (IMPs). At the moment there are dozens of similar features in the lunar maria[1], describing them as IMPs. Because of the unusual and complex characteristics of IMPs, their specific mechanism of formation is being discussed.

Maskelyne is one of unusual and large IMPs, a ~3×3 km depression composed of bleb-like mounds surrounded by hummocky and blocky terrains.

The phase-ratio technique [2] is a powerful tool to investigate the lunar surface, especially, being applied to LROC NAC data with resolution on order of 1 m [3-6]. A new approach to photometric corrections based on photoclinometry technique proposed in [7] allows one to obtain phase-ratio of higher-quality for the subsequent analysis. Also, the corrected albedo images obtained using the proposed method [7] allow to carry out more accurate analysis of the phase dependence of albedo for selected areas on the image.

New photometric studies provide additional information for understanding the mechanisms of formation of Maskelyne and other IMPs.

Phase-ratio: We demonstrate results of photometric analysis of IMP Maskelyne (4.33°N, 33.75°E) (Fig. 1). Figure 2 shows the phase ratio $A_{eq}(62°)/A_{eq}(44°)$ of the area (approximately 5.0 × 5.0 km). The structure anomalies of Maskelyne are very well expressed and effectively discriminated on phase-ratio image.

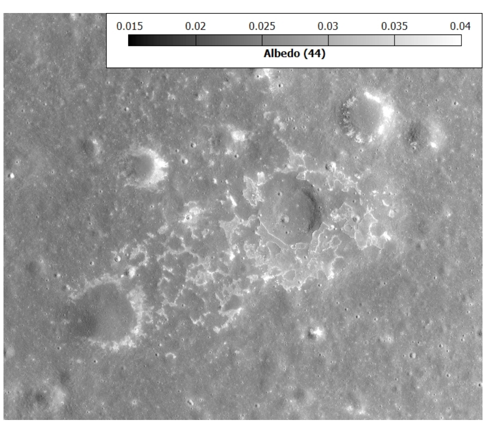

Figure 1. Apparent albedo $A(44°)$ of IMP Maskelyne (mosaics of LROC NAC images M1129269012LC and M1129269012RC).

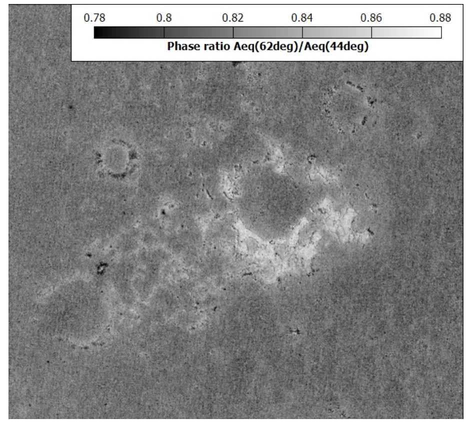

Figure 2. The phase ratio of equigonal albedo $A_{eq}(62°)/A_{eq}(44°)$ of the IMP Maskelyne (ratio of mosaics constructed on the base of LROC NAC images M1129261900LC+M1129261900RC and M1129269012LC+M1129269012RC).

The obtained phase ratio shows differences in phase curve slope for mare, "hummocky" and "blocky" regions, which caused by dissimilarity in optical roughness.

Phase dependence of albedo: We obtained phase dependence of equigonal albedo [3,8] for the selected region of Maskelyne in the range of phase angles from 1.7° to 113.1°. In Figure 3, equigonal albedo at phase angle 1.7° of the Maskelyne area and selected areas marked by frames 30×30 pixels that used for averaging are presented. Before this, all used images have been coregistered, combined and corrected for the geometric and photometric influence of topography according to the technique described in [7].

In Figure 4, the phase dependence of equigonal albedo for the selected Maskelyne regions are presented. As one can see, at small phase angles, the mare areas tend to be brighter than hummocky dark areas; whereas, at larger phase angles an inversion can be observed. The same effect can be observed for the halos of lunar craters [9]. Obviously, the contrast “mare – hummocky” changes with the phase angle due to difference in surface roughness.

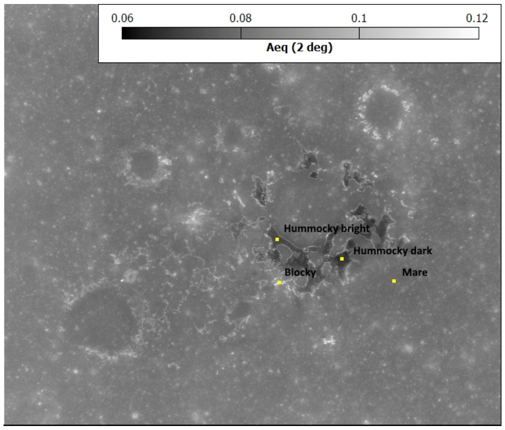

Figure 3. Equigonal albedo $A_{eq}(2°)$ of IMP Maskelyne (mosaic of LROC NAC images M1243420944LC and M1243420944RC)

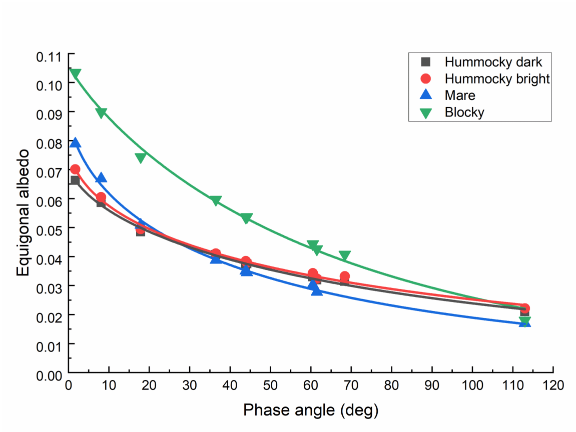

Figure 4. Equigonal albedo for the selected Maskelyne areas shown in Fig. 3.

Conclusion: The obtained phase ratio and phase dependences of albedo show significant differences in the optical (photometric) properties of the regolith of the regions related to the Maskeline formation in comparison with surrounding areas, which indicates their different nature of formation.

References: [1] Qiao, L., et al., (2020). *JGR Planets*, 125. [2] Shkuratov et al. (1994) *Icarus* 109, 168–190. [3] Shkuratov et al. (2011) *PSS* 59, 1326–1371. [4] Kaydash et al. (2012) *JQSRT* 113(18), 2601-2607. [5] Shkuratov et al. (2012) *Icarus* 218, 525-533. [6] Shkuratov et al. (2010) *Icarus* 208, 20-30. [7] Velichko et. al. (2020) *PSS* 193, 1-13. [8] Velikodsky et al. (2016) *Icarus* 275 1–15. [9] Kaydash et al, (2014) *Icarus* 231, 22–33