**PRELIMINARY MAPPING NEGATIVE POLARIZATION OF THE LUNAR NEARSIDE.** N. Opanasenko,[1] Y. Shkuratov,[1] V. Kaydash,[1] V. Korokhin,[1] Y. Velikodsky,[1] and G. Videen,[2] [1]Astronomical Institute of Kharkov National University, Sumskaya 35, Kharkov 61022, Ukraine ( astrochamp@yandex.ua ), [2]Space Science Institute, 4750 Walnut St. Suite 205, Boulder CO 80301, USA.

**Introduction:** The Moon and other atmosphereless celestial bodies reveal a complicated phase curve of linear polarization. In particular, for the Moon there is a minimum of polarization that is negative and equals about –1% at 11°; a maximum (about +7%) occurs at $\alpha_{max} \approx 105°$ for $\lambda \approx 600$ nm (positive polarization) [1]. The phase angle at which the negative polarization transforms to the positive one is called the inversion angle $\alpha_{inv}$ and is approximately 23°. Investigations of the parameters of the negative polarization branch at small phase angles are complicated, since it is a relatively weak effect.

The negative polarization of the light scattered by regolith-like surfaces may arise probably due to several reasons [2]. For the Moon the main reason seems to be the negative polarization from single-particle scattering. It has been shown experimentally [3] that this polarization is an intrinsic characteristic of irregularly shaped particles having sizes comparable to the wavelength. The nature of this negative polarization is not completely understood; therefore, this line of lunar measurements was not adequately developed. Nevertheless, imaging polarimetry of the Moon is continued from time to time [4].

**Data source:** In August – October 2010 a series of imaging photopolarimetric observations of the Moon were carried out with a 60-cm telescope at the Maidanak Observatory (Uzbekistan). We used a CMOS-camera Canon EOS 550D, which allows us to acquired images of small potions of the lunar disk simultaneously in 3 spectral bands (603, 529, and 472 nm). More detailed description can be found in [5]. We here present only data on filter 529 nm carried out at phase angles 8º-11.5º and brought to 10.6º (the minimum of the negative polarization). Using the telescope, the whole disk of the Moon was scanned during the night on October 23, 2010 with the frame of about 1/15 of the disk size. Thus, polarization degree near its minimum $P_{min}$ was obtained. A preliminary mosaic of this parameter is shown in Fig. 1. We used this to prepare a color polarimetric map presented in Fig. 2.

**Results:** As can be seen, the magnitude of the minimum of the negative polarization, being as low as about 1.1 %, varies over the lunar surface in the range of about 0.6–1.4 %. The mare/highland boundary is weakly contrasting; however, it can be traced almost everywhere. The largest values of the polarization degree close to the parameter $|P_{min}|$ appear to be typical of surface regions with medium albedo. For the mare regions the lowest values of $|P_{min}|$ are to the northeast of the crater Flamsteed and the west of the Mare Serenitatis and Mare Tranquillitatis. These areas are weakly distinguishable in albedo. Marius Hills and Aristarchus Plateau have higher polarization degree $|P_{min}|$. Many bright craters and their rays also are seen in Figs. 1 and 2. The typical values of $|P_{min}|$ here are 0.6–0.8%. It is worth noting that not all bright craters are distinguished by the parameter $P_{min}$. This can be caused by the different ratio of the fine and coarse fractions in the lunar regolith. The high values of $|P_{min}|$ are typical of some highland areas and small bright formations located in the maria. The $|P_{min}|$–albedo correlation diagram has a complex, horseshoe-shaped appearance [6]: for low-albedo surfaces, a direct correlation is observed, while for the high-albedo surfaces, an inverse correlation exists.

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**References:** [1] Dollfus A. and Bowell E. (1971) *Astron. Astrophys.* 10, 29-53. [2] Shkuratov Y. et al. (1994) *Earth, Moon, Planets* 65, 201-246. [3] Munoz et al. (2000) *Astron. Astrophys.* 360, 777-788. [4] Shkuratov Y. et al. (2008) *Icarus* 198, 1-6. [5] Velikodsky Y. et al. (2011) *Icarus* 214, 30-45. [6] Shkuratov Y., Opanasenko N. (1992) *Icarus* 99, 468

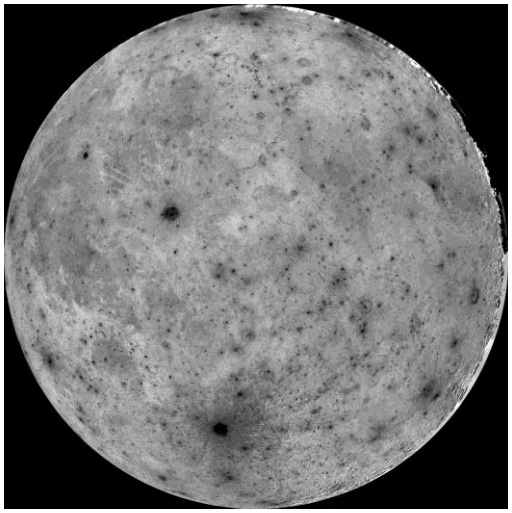

Figure 1. A mosaic of polarization degree close to $P_{min}$ for the lunar nearside.

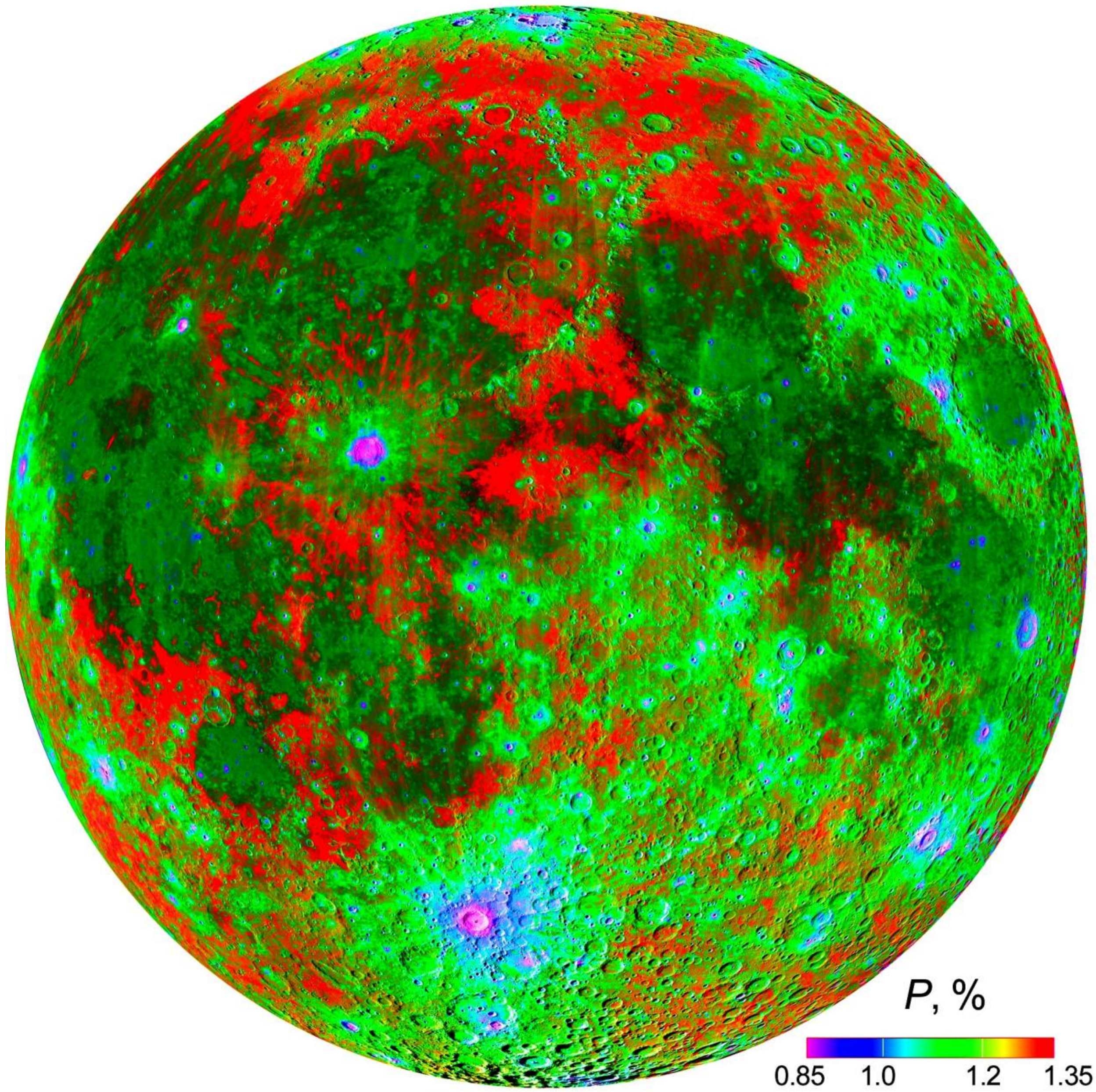


Figure 2. A preliminary map of the lunar nearside for the polarization degree close to $P_{min}$.