IS THERE UMOV EFFECT FOR THE MOON IN POLARIZATION MINIMUM ?

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The first polarimetric image of the central part of the lunar disk at a phase angle of about 10 degrees is presented. Regions of an intermediate albedo which are associated with mare / highland transition zones show increased values of $|P_{min}|$. The correlation diagram P_{min} - albedo has a horseshoe shape, which can be explained by the coherent backscatter mechanism of the negative polarization.

This paper continues our publications devoted to "exotic" characteristics of the lunar surface on the base of photometric and polarimetric data [2,3,7].

The Umov effect is an inverse correlation between polarization degree (P) and albedo (A) of a light-scattering surface. This effect is known to be revealed for the Moon at large enough phase angles when a positive polarization is observed [1-4]. The correlation is linear on a log-log scale. Recently, a similar dependence was also found for degree of the negative polarization ($|P_{min}|$), though, as turns out, it is justified only for regions with high enough albedo, being linear. For very dark regions the dependence is directly proportional. Thus, the dependence $P_{min}(A)$ has a horseshoe form. This result has been obtained on the base of discrete photopolarimetric observations of a few hundreds of lunar sites and of laboratory measurements of samples which are structure analogs of lunar regolith [3,4]. It is necessary to confirm the findings using more representative data, e.g., images of parameters $|P_{min}|$ and A.

Until recent time, the parameter P_{min} of the Moon had been considered as a characteristic which has practically no regional variations [5]. For the first time such variations were suspected by Kvaratskhelia [4]. Later they were confirmed in [3] where it was shown that the variations are in the interval 0,5 - 1,5%. To take an image of P_{min} we decided to use the photographic method in combination with discrete photopolarimetric data needed for calibration and photometric correction of original photographic images. The original images corresponding to two orientations of polaroid were taken by a 60 cm telescope in red light at a phase angle of about 10 degrees. These images were put in a computer memory by the special microdensitometer [6] which provides us with suitable quantization (of about 2000 photometric levels). Image calibration and photometric corrections were made using the data from [3]. Some details of the procedure of preparation of the image of polarization degree can be found in [7]. The P_{min} image of the central part of the lunar disk is shown in Fig.1. This is the first image of the Moon in the parameter P_{min}.

One can see that young craters and the ray systems show up. These units are characterized by low values of P_{min} (dark tone in the figure). Immature soils of the units have coarse regolith which is optically homogeneous as compared to the mare regolith. It agrees with the data of our laboratory studies of structure imitators of lunar grounds [3]. Regions with an intermediate albedo which are associated with mare/highland transition zones reveal increased values of $|P_{min}|$. According to the laboratory data [3] this feature can be due to the effect of mixing of optically contrasting (mare and highland) grounds.

Having images of $|P_{min}|$ and A, we can study the correlation diagram $|P_{min}|$-A (see Fig.2). Indeed, it has the horseshoe form which is explained in the frame of the so-called coherent backscatter mechanism of the negative polarization [8].

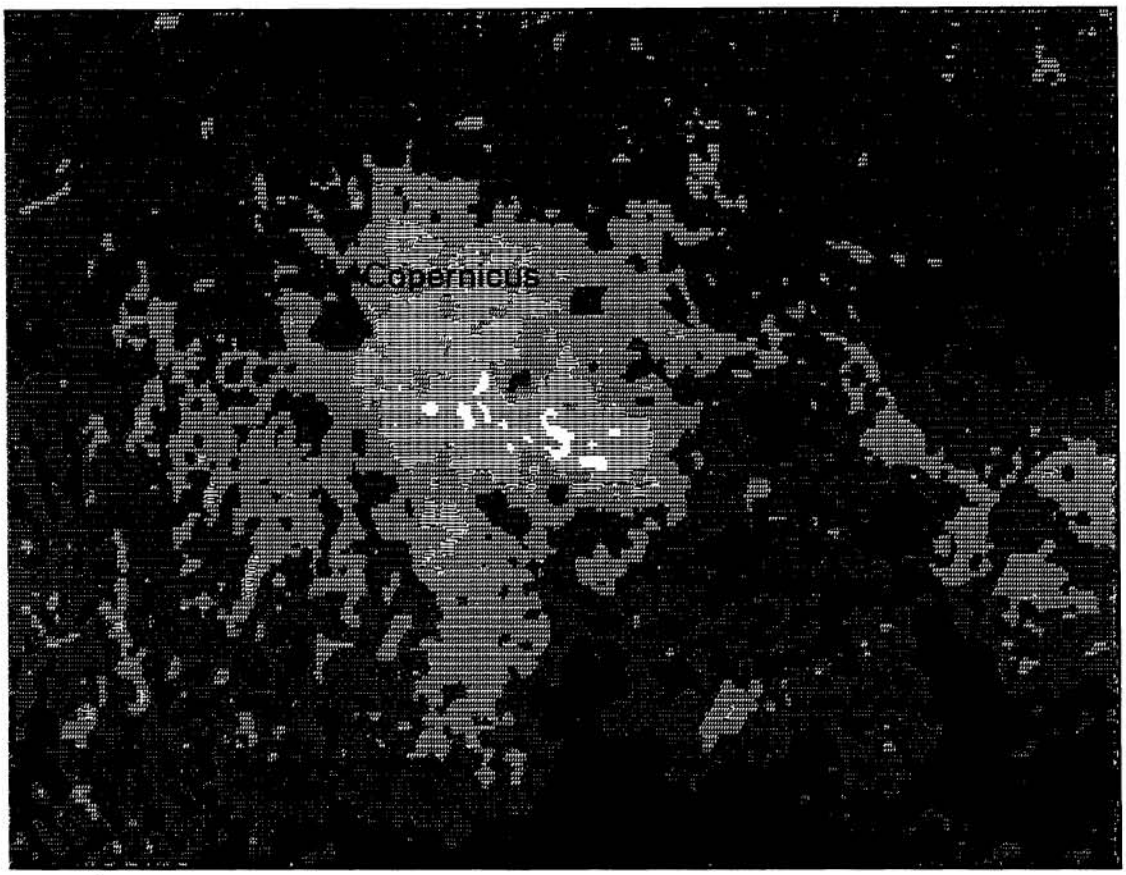

Fig.1. Image of P_{min} for central part of lunar disk

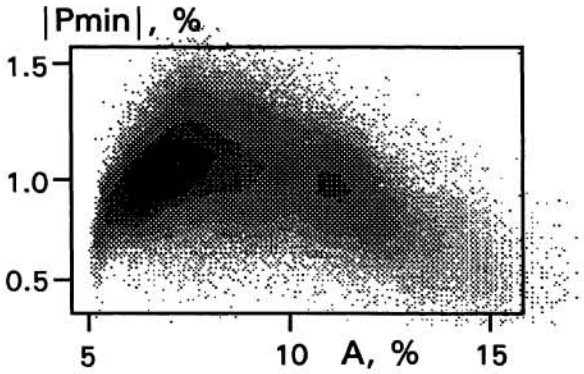

Fig. 2. Diagram $|P_{min}|$ - Albedo

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