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Photometric anomalies of the lunar surface and the lunar opposition effect from AMIE SMART-1 data.

V. Kaydash (1), M. Kreslavsky (2), Yu. Shkuratov (1), S. Gerasimenko (1), P. Pinet (3), S. Chevrel (3), J.-L. Josset (4), S. Beauvivre (4), B. Foing (5), and AMIE Smart-1 team

(1) Astronomical Institute of Kharkov National. University, Sumskaya 35, Kharkov, 61022 Ukraine, (2) University of California, Santa Cruz, CA, USA (3) UMR 5562/CNRS/ Toulouse III University, Midi-Pyrenees Observatory, 14 Av. E. Belin, 31400 Toulouse, France. (4) Space Exploration Institute (Case postale, CH-2002 Neuchâtel, Switzerland) (5) ESA/ESTEC (Keplerlaan 1, 2201 Noordwijk, The Netherlands) kvg@vk.kh.ua

Images obtained in 2005-2006 by the Advanced Moon Micro-Imager Experiment (AMIE) camera onboard SMART-1 spacecraft allow access to photometric properties of the lunar regolith. Our preliminary study reveals new photometric anomalies detected at a typical 100 m/pix resolution. Crater-related negative anomalies were observed as diffuse halos of less steep phase function of brightness (these halos typically are not seen in albedo). Also we found zones with steeper phase function in the proximal ejecta of some craters; we interpret these positive anomalies as an increase of mesoscale roughness. Large-scale subtle variations of phase function steepness over the mare surface might be caused by fine-grained pyroclastic material in the vicinity of volcanic domes or tectonic fractures across the crater floors. Another type of negative photometric anomaly we found is associated with material chemically and structurally different from underlying mare surface. We use AMIE data to study the opposition spike for several sites and estimate the steepness of phase function in the phase angle range 0 - 2.5 deg. Resulting phase functions show a monotonic increase of brightness from 2.5 to 0 deg. with some diversity of slopes. We believe this diversity is a real effect and reflects variations of amount of craters ejecta material. The average phase slope of 13-14% at the phase angle range 0 - 1.5 deg. is in quantitative agreement with previous opposition spike studies using Clementine data.