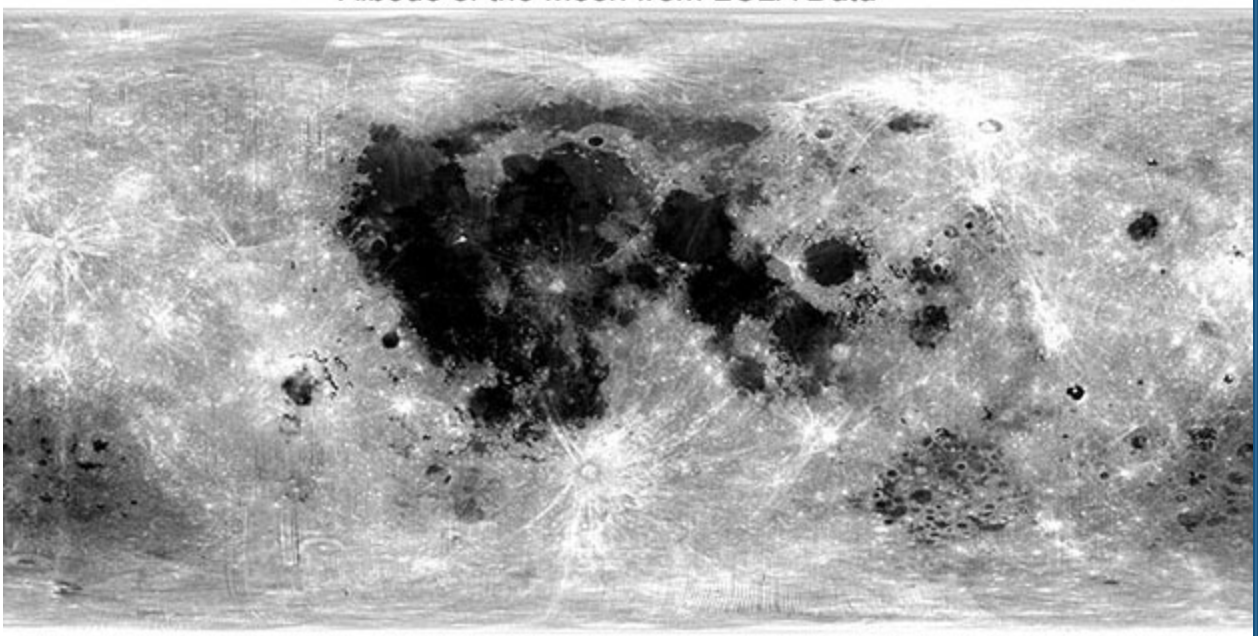
PLANETARY SCIENCE RESEARCH DISCOVERIES
CosmoSparks

Quick Views of Big Advances

An Improved Calibration of Reflectance Data from LOLA

Myriam Lemelin (University of Hawai'i) and colleagues from Hawai'i, NASA Goddard Space Flight Center, Sigma Space Corporation, and MIT have produced a new calibration of the reflectance measurements from the Lunar Orbiter Laser Altimeter (LOLA) on NASA's Lunar Reconnaissance Orbiter. Corrections provide lower uncertainties overall and improvements in the polar regions from the initial calibration done by Paul Lucey (University of Hawai'i) and coauthors in 2014, and the new global ***albedo*** map of the Moon is shown below. Using the new reflectance data and Lunar Prospector's Neutron Spectrometer data, Lemelin and colleagues confirm the 2015 discovery, by Douglas Hemingway (University of California Santa Cruz) and colleagues, of the latitudinal variation in albedo and spectral properties of the Moon's ***maria*** (see **PSRD** CosmoSparks report: ***Space Weathering on the Moon—By Degrees Latitude***). High latitude maria have higher albedo and lower 950nm/750nm reflectance ratios than maria closer to the Moon's equator. Now two teams have separately shown that this systematic trend is independent of mare basalt composition, illumination or viewing angles.

Albedo of the Moon from LOLA Data



(LRO 24 GDR pds-geosciences Lemelin *et al.* (2016) *Icarus*, v. 273, p. 315-328, doi: 10.1016/j.icarus.2016.02.006.)

Albedo map of the Moon created by Lemelin and colleagues (2016) based on radiometry calculated from data acquired by laser 1 of the LOLA instrument. In this global view, the calculated normal albedo values range from 0.10 to 0.50.

Because reflectance data are used to interpret the extent of ***space weathering*** on airless bodies, Lemelin and coauthors investigated whether or not the nonuniform albedo of the maria would introduce errors in photometric normalization—the commonly used technique in photographic and image processing to correct for variations in local viewing geometry defined by ***incidence***, ***emission***, and ***phase*** angles. For example, the team used two different albedo values, 0.18 and 0.22, to calculate the normalized reflectance of maria at 60^{o} latitude and found the error to be very small: ≤ 2% for the majority of near-***nadir*** geometries and 3-4% for unusual geometries. With this in mind, researchers can compare reflectance data of lunar mare deposits at different latitudes knowing that the albedo variations exist but are, perhaps, weak enough to be insignificant in photometric models.

This research paper is part of an *Icarus* special issue on results from NASA's Lunar Reconnaissance Orbiter data.

See the ***Icarus vol. 273*** table of contents. This special issue features 28 papers concerning the most recent discoveries about lunar volatiles, regolith properties, lunar swirls, cratering and impacts, space weathering, volcanism, and topography.

(pdf version)

See Reference:

· Lemelin, M., Lucey, P. G., Neumann, G. A., Mazarico, E. M., Barker, M. K., Kakazu, A., Trang, D., Smith, D. E., and Zuber, M. T. (2016) Improved Calibration of Reflectance Data from the LRO Lunar Orbiter Laser Altimeter (LOLA) and Implications for Space Weathering, *Icarus,* v. 273, p. 315-328, doi: 10.1016/j.icarus.2016.02.006. [***abstract***]

See also:

· Hemingway, D. J., Garrick-Bethell I., and Kreslavsky, M. A. (2015) Latitudinal Variation in Spectral Properties of the Lunar Maria and Implications for Space Weathering, *Icarus,* v. 261, p. 66-79, doi: 10.1016/j.icarus.2015.08.004. [***abstract***]

· **PSRD** report ***Space Weathering on the Moon—By Degrees Latitude***

· Lucey, P. G., Neumann, G. A., Riner, M. A., Mazarico, E., Smith, D. E., Zuber, M. T., Paige, D. A., Bussey, D. B., Cahill, J. T., McGovern, A., Isaacson, P., Corley, L. M. Torrence, M. H., Melosh, H. J., Head, J. W., and Song, E. (2014) The Global Albedo of the Moon at 1064nm from LOLA, *Journal of Geophysical Research–Planets,* v. 119(7), p. 1665-1679, doi: 10.1002/2013JE004592. [***abstract***]

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