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Space Weathering on the Moon–By Degrees Latitude

Researchers propose that reduced solar wind flux toward higher latitudes is the reason for systematic near-infrared spectral variations in lunar maria.

Research has shown that ***space weathering*** changes the physical structure, optical properties, chemical or mineralogical properties of the surface of airless planetary bodies from their original state. Now a team of researchers say the solar wind flux, not just the total amount of space weathering, has a profound effect on the Moon's surface spectral properties and may need to be considered when interpreting spectral measurements, especially at high latitudes.

Douglas Hemingway (University of California Santa Cruz), Ian Garrick-Bethell (UC Santa Cruz and Kyung Hee University), and Mikhail Kreslavsky (UC Santa Cruz) documented, for the first time, the latitude dependence of the near-infrared spectral properties of lunar maria. Using primarily Clementine UVVIS data (supported by LOLA and Lunar Prospector gamma ray data), the team mapped the systematic variation in spectral properties and found that lower latitude maria are darker (lower ***albedo***) and have higher 950 nm/750 nm reflectance ratios than high latitude maria. Their work shows that the latitudinal trends are not due to changes in composition, contamination by highland rocks or crater rays, or by phase angle biases in the Clementine data.

Decreases in albedo and increases in the 950 nm/750 nm band ratio are characteristics of mature surfaces where the combined changes caused by space weathering have reached a steady state. Significantly, Hemingway and coauthors found the spectral reflectance variations in the maria are unlike the trends of gradual space weathering by micrometeorite bombardment, but rather, statistically equivalent to those associated with ***lunar swirls***.

The team reports that the higher-latitude mare regions appear spectrally similar to bright lunar swirls. Hemingway and colleagues suggest a likely mechanism for this similarity is solar wind flux, which is reduced at higher latitudes (because of higher incidence angles) and very likely reduced at lunar swirls (which are typically co-located with strong magnetic fields that can deflect the solar wind). This work supports previous and on-going efforts to better understand and quantify the relative contributions to space weathering by the solar wind's charged particles versus micrometeorite bombardment. Additional lines of research will be highlighted in the Thursday afternoon space weathering session at the 47th Lunar and Planetary Science Conference taking place next month: ***See the LPSC program with abstracts***.

See Reference:

· 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***]

See related **PSRD** ***articles about space weathering***.

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