Comparison of Multiple Sphere T-matrix and Mie models for space weathering relevant materials

Carey Legett IV[a*], Timothy D. Glotch[a], and Paul G. Lucey[b]

[a]*Stony Brook University, 255 Earth and Space Sciences, Stony Brook, NY 11794-2100, USA*
[b]*Hawaii Institute of Geophysics & Planetology, 2525 Correa Road, University of Hawaii, Honolulu, HI 96822, USA*

[*]*Presenting author (carey.legett@stonybrook.edu)*

Space weathering can be defined as the gradual changes experienced by the surfaces of airless planetary bodies due to exposure to the vacuum of space, radiation, and micrometeorite bombardment. Characteristic VNIR spectral changes due to space weathering include a decrease in albedo and a general "reddening" of spectra (increasing reflectance with increasing wavelength). Apollo-returned lunar soils contain grains with amorphous rims with nanophase metallic-iron particles ($npFe^0$) dispersed throughout. Absorbing particles of this scale (tens of nm) have very strong optical effects. The size of the $npFe^0$ particles determines the amount of reddening observed with smaller particles being associated with redder spectra than larger particles. A transition occurs at a particle size of ~30–50 nm, above which the spectra darken without reddening. Previous modeling work has failed to robustly reproduce this transition at the observed iron particle size, instead requiring larger particles. We present work comparing the use of the Multiple Sphere T-matrix Model and a Mie model on several cases relevant to the space-weathered lunar soil grains. Scattering and extinction efficiencies and phase function data are taken from these models as inputs to a bidirectional reflectance model for comparison to remote sensing datasets of planetary surfaces.

Preferred mode of presentation: Poster