THE MODELED REFLECTANCE SPECTRUM OF ASTEROID (4) VESTA

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Introduction: Asteroids provide us information on the evolution of the Solar System and by studying their reflectance spectra we can learn about the mineralogy and size distribution of the grains on asteroid surfaces. The spectra have been interpreted by numerous laboratory studies and empirical or semi-physical models, such as the Hapke model [1], but never before using physics-based light scattering codes. We have developed a new simulation framework to model the reflectance spectra of planetary materials. To demonstrate our approach, we use a howardite sample to model the reflectance spectrum of asteroid (4) Vesta, and to obtain the size distribution for the regolith particles on Vesta's surface.

Spectral Modeling: Spectral modeling is carried out in multiple parts: the Superposition T-Matrix Method (STMM, [2]) is used to compute scattering matrices and single-scattering albedos for small porous howardite volume elements. The computed elements are then used as diffuse scatterers in SIRIS4 [3,4], a ray optics code that simulates light scattering by Gaussian-random-sphere particles larger than the wavelength of the incident light, to compute the scattering matrices and single-scattering albedos for large howardite particles (grain sizes ranging from a few micrometers to hundreds of micrometers). Finally, we average the particles over a power law distribution to obtain the asteroid spectrum.

References:

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