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Multiple-scattering modeling for asteroid photometry and polarimetry

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Multiple scattering of sunlight by an asteroid depends on the small-scale physical characteristics of its regolith such as surface roughness, volume density, particle size, shape, and structure and its large-scale physical characteristics such as rotation period, pole orientation, and global shape. Here we focus on the small-scale characteristics, providing an external internal multiple-scattering model (EI) to interprete the photometric and polarimetric observations of asteroids. In the EI model, multiple scattering effects are taken into account within regolith particles with sizes large compared tothe wavelength (internal multiple scattering), as well as among such particles (external multiple scattering). The recent advances allow an efficient Monte Carlo computation of coherent backscattering effects (e.g., Waves in Random Media 14, 365, 2004). Shadowing due to the rough surface and the porous regolith is accurately computed using numerical simulations. Simultaneous coherent-backscattering modeling of asteroid photometric and polarimetric phase effects is shown for different asteroid classes.