Application of the multiple-scattering modeling pipeline for spectroscopy, polarimetry, and photometry

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We present the application of a newly developed data-processing and analysis pipeline (Penttilä et al., this meeting) to analyze the reflectance spectra and photometric and polarimetric phase curves of close-packed random media. In the software suite, light-scattering characteristics of the sample are modeled using novel multiple scattering methods for close-packed random media, such as a geometric optics method SIRIS4 [1] and the radiative transfer with reciprocal transactions R^2T^2 [2]. The R^2T^2 method solves the ensemble-averaged Foldy–Lax equation involving the ladder and maximally crossed diagrams as well as the near field corrections. The near field corrections are implemented in terms of the incoherent volume element containing all the scattering diagrams that do not cancel out in the near-zone [2]. The incoherent scattering parameters of the volume elements are solved exactly by the fast superposition T-matrix method [3]. The latter enables us to extend the applicability of the radiative transfer to close-packed random media [2].

Application of the software suite to the defined close-packed random media is followed by comparison with experimental results. Among suitable planetary analog samples for the experimental study are, for example, macroscopic agglomerates formed by ballistic hit-and-stick deposition [4]. The agglomerates consist of monodisperse SiO_2 spheres and their light-scattering characteristics are thoroughly measured with the new scatterometer setup [5,6].

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References

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