Improving the radiative transfer approximation in the geometric optics regime

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We have developed a set of light-scattering tools which can be used to model the spectroscopy, photometry, and polarimetry of planetary surfaces by linking the tools as a pipeline [1,2]. In these pipelines, scattering by densely packed media in the geometric optics regime is approximated by utilizing radiative transfer. A single diffuse scatterer is created by mixing light-scattering characteristics of individual particles statistically, which is then used as input in the SIRIS4 [2–4]. The problem is that the current approach neglects the so-called shadowing effect.

In order to study the effects of particles shadowing each other, we have developed a new version of the SIRIS which is capable of handling arbitrary geometries. Still, computing multiple scattering from millions of particles with multiple facets in the geometric optics regime is too computer-intensive, and hence we need to utilize our existing radiative transfer approach with possible corrections. We study approaches which might be used to improve the existing pipeline, such as using volume elements to replace the statistically diffuse scatterer or adding particles on top of the geometry containing diffuse scatterers.

References

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