Numerical modelling of light scattering and absorption by large cometary dust particles

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Rosetta mission has provided direct measurements of a size distribution, composition and morphology of cometary dust particles. Observations with the MIDAS and COSIMA instruments have revealed that cometary dust consists of highly porous hierarchically aggregated particles as well as solid particles [1,2]. The size distribution determined from the captured dust particles shows high abundance of large particles which in turn dominate the light scattering characteristics of dust in the coma. This creates a need for a new computational method for light scattering analysis of cometary dust since typical light scattering simulations involve methods such as the discrete dipole approximation and superposition T-matrix method which, in practise, are applicable to particle sizes less than a few micrometers [4,5] at optical wavelengths.

We have developed an approximate numerical method based on the radiative transfer theory in dense discrete random media entitled as radiative transfer with reciprocal transactions R^2T^2 [6]. The R^2T^2 method has been shown to reproduce light scattering characteristics for particles of sizes $\sim 10\,\mu m$ when compared to the exact electromagnetic solvers. Yet it is applicable to, with a reasonable computational effort, up to 1mm sized and even larger porous dust particles. In this work will apply the R^2T^2 method to model light scattering by realistic cometary dust particles.

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References:

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