Modeling of Irregular Shaped Dust Particles using DDA with Light Scattering Studies for Analogue Samples

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Abstract—*Light scattering studies of irregularly shaped dust particles with sizes comparable to wavelength are important for remote-sensing atmospheric and astrophysical applications. The laboratory based characterization of dust analogue samples supported by computational tools (Mie scattering theory, DDA, T-matrix, and FDTD) helps in interpretation of scattered radiation patterns from terrestrial and cosmic dust, interstellar medium, planetary regolith etc. The exact representation of irregularly shaped dust particles using analogue samples and theoretical models are extremely difficult, due to the lack of sufficient knowledge about shape, size and scattering properties of those particles. The most realistic approach for such studies is to design particle model of arbitrary shapes and sizes which most likely supposed to constitute the interstellar dust, using computational tools and measure the scattering parameters. This data can be used to compare with results acquired by observations and laboratory based experiments of analogue samples. In this work we are using the discrete dipole approximation (DDA) for a quantitative study of the optical properties of different size, shape, composition, and aggregation state of dust particles (mainly Graphite) in the visible wavelength region. We designed irregular and complex particle models using 3D geometry generation software (in this case Blender) for computational studies of dust particles, which is capable of computing absorption and scattering properties of particles with arbitrary shapes and geometries. We report the computational light scattering studies of dust particles of arbitrary shapes ranging from a size range of 500nm to 5μm in radius, for relevant incident wavelengths i.e. comparable to particle sizes ($x \approx \lambda$), using DDSCAT 7.3.0 and an indigenously developed post process tool for both single particle and aggregates, supported by experimental results for available laser wavelengths of 632.8nm and 543.5nm in the laboratory.*

Keywords*: DDA, Light scattering, dust, size distribution.*

References

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