ELS-XV-2015 Abstracts
ELS-XV-2015-121
Electromagnetic & Light Scattering XV 2015, Leipzig

Determination of significant scattering matrix of small particles at different visible wavelengths by Monte-Carlo simulation

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Determination of significant scattering matrix of small particles at different visible wavelengths by Monte-Carlo simulation

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Keywords: light scattering, Mueller matrix, Mie- theory, T-matrix method, Monte-Carlo simulation

Simulation of experiments provide better insight into the experiments done in laboratory, besides being relatively inexpensive, faster and easier method for performing an experiment on the computer. In this paper, we present the simulation technique used for light scattering analysis of small particles including semiconductor nanoparticles and biological particles. It is important to mention that the studies of organic molecules may also be utilized in interpretation of data that is obtained from Astrophysical studies on the presence of organic molecules in stellar and interstellar medium. Semiconductor sub-micron particles holds importance for its application in optoelectronic devices, solar cells etc. Several Monte Carlo simulations have been developed in the past to investigate the propagation of light. We describe here an original Monte Carlo code that was developed to compute the electromagnetic scattering of ensemble of randomly oriented small particles having different morphologies at different visible wavelengths. The usability of our simulation program “simscat.c” has been tested in different computers and verified. One main step followed in all the simulations of light scattering based on Monte Carlo method, is the sampling of scattering angles. Basically, it deals with calculation of S11 and S12 element of the Mueller matrix. Our findings showed uniqueness in simulation results corresponding to different wavelengths. These computations were carried out in order to simulate and analyze the most significant element of the Mueller matrix based on Mie theory which specifies the profiles of volume scattering function and degree of linear polarization. The closeness of agreement or disagreement with the experimental and theoretical results provided clues to understand the scattering behaviour of such particles in a better way. The code may also be used incorporating the T-matrix theory for randomly oriented non-spherical particles. Our results call for a need to compare experimental results routinely with simulation results for other clues and better explanations about the morphology of the particles.

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