Physical optics method for solving light scattering problem for large particles over all scattering directions

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The physical optics method [1] developed at the V. E. Zuev Institute of Atmospheric Optics has been successfully used to solve the light scattering problem for atmospheric ice crystals in the backward scattering direction for lidar applications [2]. The solution of the light scattering problem for ice crystals ranging in size from 10 to 1000 micrometers (size parameters from 60 up to 6000) has been obtained with this method. For small particles, the physical optics approximation is in good agreement with exact numerical methods [3] (such as the DDA and FDTD), while for large particles the solution converges to the solution obtained within the framework of the geometrical optics approximation.

The talk presents a modification of the physical optics method that allows one to obtain a solution to the light scattering problem over all scattering angles (the entire sphere of scattering directions). It shows that starting from a size parameter of 50 the solution agrees well with the solution obtained by the ADDA. Since the computational complexity of the method does not increase with increasing particle size, while the accuracy of the method, on the contrary, becomes better, the physical optics method is a promising technique for solving the light scattering problem for particles much larger then the wavelength of the incident light. In the report, the capabilities of the method are exemplified by solving the light scattering problem for a large fraction of dust aerosol particles.

References

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