SCATTERING CROSS-SECTION FROM RANDOMLY ORIENTED PARTICLES

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Scattering cross section from a cloud of identical, arbitrarily oriented particles is often of interest in practical applications. If multiple scattering between particles can be neglected, the problem reduces to averaging of appropriate scattering cross-section over particle orientation. This problem is easily solved in the case of Rayleigh scattering. It seems that the other limiting case of geometric optics (GO) was overlooked in the literature. It is demonstrated in this talk that within limits of the GO approximation orientation-averaged scattering cross-section from a convex dielectric particle at a given angle is proportional to the product of a square modulus of the Fresnel reflection coefficient and a total area of the particle surface. For in-plane and orthogonal-to-plane scattering the Fresnel reflection coefficient corresponds to p- and s-polarization, correspondingly (cross-polarization scattering cross-section in the GO limit turns to zero). The proof is based on Gauss mapping and is very similar to the proof of the Gauss-Bonnet formulae. Simple treatment of the Rayleigh scattering case will be also presented in the talk.

The results obtained could be used for particle remote sensing applications. In the low-frequency (Rayleigh) limit orientation-averaged scattering cross-section depends on three parameters: a volume of a particle and two form-factors which depend on particle shape, and has both isotropic and dipole components. Thus, to determine those parameters one has to make one absolute and two relative measurements using different angles and/or polarizations. In the high-frequency (GO) limit for convex particles orientation-averaged scattering cross-section depends on dielectric constant of the particle and is directly proportional to the total area of the particle surface. Angular dependency of the scattering cross-section coincides with the corresponding angular dependency of the appropriate Fresnel reflection coefficient. Thus, for perfect conductor scattering is isotropic.

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2. B - Fields and Waves
3. (a)
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