

# Scattering by particles in an absorbing medium

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In this talk we review the recently developed first-principles approach to electromagnetic scattering by particles immersed in an unbounded absorbing host medium [1]. This formalism enables one to solve the following two important problems: (i) simulate theoretically the (polarized) reading of a remote well-collimated radiometer measuring electromagnetic scattering by an individual particle or a small random group of particles; and (ii) compute the single-scattering parameters that enter the vector radiative transfer equation derived directly from the Maxwell equations [2]. We then introduce an actual computational tool in the form of a public-domain FORTRAN program [3] for the calculation of pertinent far-field optical observables in the context of the classical Lorenz–Mie theory of electromagnetic scattering by homogeneous spherical particles [4].

We apply this program to a limited yet representative set of problems [5,6]. We identify and analyze the remarkable phenomenon of negative extinction and provide voluminous evidence in favor of its interference origin (cf. [7]). We study the main effects of increasing the width of the size distribution on the ensemble-averaged extinction efficiency factor and show that negative extinction can be eradicated by averaging over a very narrow size distribution. We also analyze the effects of absorption inside the host medium and ensemble averaging on the phase function and other elements of the Stokes scattering matrix. It is shown in particular that increasing absorption can result in a dramatic expansion of the areas of positive polarization, while the phase functions at larger effective size parameters can develop a very deep minimum at side-scattering angles bracketed by a strong diffraction peak in the forward direction and a pronounced backscattering maximum.

## References

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