Fast Algorithms for Multi-particle Scattering and Its Inverse Problem

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Electromagnetic scattering of multiple particles appears in a lot of applications, including biophysics and solar cell design. For instance, given the property of a single particle, it is often desired to obtain a composite material with a given electromagnetic response. Fast algorithm is needed to solve such an optimization problem. In this talk, the speaker will talk about the numerical algorithms based on integral equations that rapidly find the scattering of multiple particles in layered medium and periodic medium. The algorithm combines several numerical techniques, including fast multipole method, non-uniform fast Fourier transform and generalized Gaussian quadrature. The time to evaluate the scattering of thousands of particles can be reduced to seconds. The speaker will also discuss some recent works on the inverse scattering problem for multiple particles.