Wave scattering by many small particles and creating materials with desired refraction coefficients

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Abstract

Many-body wave scattering problems are solved asymptotically, as the size a of the particles tends to zero and the number of the particles tends to infinity. Acoustic, quantum-mechanical, and electromagnetic wave scattering by many small particles are studied. Computational methods for solving many-body wave scattering problems in the case of small scatterers are developed. They allow one to treat wave scattering by as many as 10^6 small particles.

This theory allows one to give a recipe for creating materials with a desired refraction coefficient.

One can create material with negative refraction, that is, the material in which the group velocity is directed opposite to the phase velocity.

One can create material with desired wave-focusing properties. For example, one can create a new material which scatters plane wave mostly in a fixed given solid angle.

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