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Wave scattering by many small impedance particles and creating materials with a desired refraction coefficient

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The theory of acoustic and electromagnetic (EM) wave scattering by one and many small impedance particles of arbitrary shapes is developed. The basic assumptions are: $a \ll d \ll \lambda$, where a is the characteristic size of particles, d is the smallest distance between the neighboring particles, λ is the wavelength. This theory allows one to give a recipe for creating materials with a desired refraction coefficient. One can create material with negative refraction: the group velocity in this material is directed opposite to the phase velocity. One can create a material with a desired wave focusing property. Equation is derived for the EM field in the medium in which many small impedance particles are embedded.

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