Abstract Submitted
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Effective permittivity of ensemble-averaged waves in dense random plasmonic composites[1] SATVIK WANI, Department of Biomedical and Chemical Engineering, Syracuse University, Syracuse, NY 13244, USA, ASHOK SANGANI[2], National Science Foundation, Arlington, VA 22230, USA, RADHAKRISHNA SURESHKUMAR, Department of Biomedical and Chemical Engineering and Department of Physics, Syracuse University, Syracuse, NY 13244, USA — Random composites of metallic nanospheres (Ag, Au, Cu, etc.) in transparent media are highly opaque due to absorption resulting from plasmon resonance. A new technique for calculating the effective properties of such dense composites is described. The underlying physical motif is the separation of the space surrounding any inclusion into two regions, one immediately surrounding the particle with the properties of the matrix (the size of this region depends on the static structure factor) and an effective medium. Self consistent closure relations are found for the conditionally averaged fields by solving the vector Helmholtz equations for a layered sphere in an infinite matrix by utilizing a multipole expansion technique. For finitely large ϕ, the effective permittivity is given by $\varepsilon_{eff}/\varepsilon_m = 1 + 3\beta\phi + {}^3\!/_4(\beta+4)\beta^2\phi^2 + O(\phi^3)$ where ε_m is the permittivity of the medium and β is the particle polarizability per unit volume. For denser systems, the particle and effective medium fields interfere to give rise to a Fano-like line shape for $Im\,(\varepsilon_{eff})$. The resonance conditions result in a ϕ dependent red-shift of the resonance peak. Effects of polydispersity and multiple particle species on ε_{eff} will be discussed.

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