Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Contribution of electric quadrupole resonance in optical metamaterials[1] DAVID CHO, FENG WANG, XIANG ZHANG, UC Berkeley, Y. RON SHEN, UC Berkeley, LBNL — Optical metamaterials are artificial structures composed of nanoscale units with unit dimension smaller than optical wavelength. They can exhibit negative index of refraction when both effective permittivity and permeability are negative. Although, negative permittivity is straightforward to obtain, negative permeability is nonexistent in nature. Only recently has it been achieved using strong magnetic resonances in suitably designed metal plasmonic nanostructures. However, similar to the magnetic resonance, electric quadrupole resonance can also be greatly enhanced by plasmon resonances. The contribution of the electric quadrupole resonance to the effective properties of metamaterials has not been well understood and often neglected. We show by simulation that, for many metamaterial structures, electric quadrupole radiation is comparable to that of magnetic dipole and we propose an experimental scheme to determine individual contribution of the electric dipole, magnetic dipole and electric quadrupole. We also show that the electric quadrupole radiation can greatly affect effective permeability, and therefore is of central importance for designing metamaterials with negative permeability.

[1]This work is supported by the National Science Foundation.

David Cho
UC Berkeley

Date submitted: 27 Nov 2007 Electronic form version 1.4