Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

From Photonic Crystals to Photonic Metamaterials. I[1] PETER HALEVI, FELIPE PEREZ-RODRIGUEZ, INAOE — We present a very general mean-field theory for a photonic crystal (dielectric or metallo-dielectric) with arbitrary (3D) Bravais lattice and arbitrary inclusions within the unit cell. The material properties are characterized by a generalized conductivity at every point in the unit cell. Averaging over many unit cells for very small Bloch wave vectors, we derive the macroscopic response for the metamaterial. This, in general, turns out to be the bianisotropic response, specified in terms of permittivity and permeability tensors and, also, "crossed" D/H and B/E tensors. These four tensors are derived in terms of the content of the unit cell. However, in case of inversion symmetry these "crossed" tensors vanish. Moreover, for cubic symmetry the system becomes isotropic, described by scalar, frequency-dependent, permittivity and permeability.The response is essentially local, although, spatial dispersion can also be accounted for. Our mean-field theory is valid for optical photonic bands, as well as acoustic bands.

[1]The authors acknoledge their CONACYT projects 41195-F and 46425-F.

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Date submitted: 05 Dec 2005 Electronic form version 1.4