Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Wannier Function Expansion of Localized States in Photonic Crystals J. D. ALBRECHT, Air Force Research Laboratory, P. SOTIRELIS, High Performance Technologies, Inc., The Advanced Computational Analysis Directorate, Wright-Patterson Air Force Base, OH — We present a theoretical treatment of localized electromagnetic modes in infinite photonic crystals. Our basis states are local vector Wannier functions calculated from the unperturbed crystal eigenstates. Analogous to the calculation of localized electronic states by expansion in terms of electronic orbitals, this Wannier basis is used to expand photonic crystal defect states. The localized nature of the basis states is critical so that the basis can be truncated after a small number of neighbor lattice sites in the vicinity of the defect. We present results that verify the eigenmodes of the crystal and examine defect modes. An analysis is done to determine the convergence of the mode as a function of the number of basis states included in the computation. This formalism equally treats localized states that are bound in a photonic band gap and states resonant with the propagating photon states of the infinite crystal. The present method has certain advantages with regard to computational complexity, spatial resolution, and the efficient accommodation of non-spherical geometric features.

Paul Sotirelis
High Performance Technologies, Inc.

Date submitted: 30 Nov 2005 Electronic form version 1.4