Physics
AT QUEENS COLLEGE

# Colloquium Notice


## John Albrecht

**Force Research Laboratory at Wright-Patterson**


## *Photonic Crystal Defect Mode Analysis*


Photonic crystals, in this case periodic structures of dielectrics, can be used to control light propagation through geometry and dielectric contrast. An especially attractive application for photonic crystals is to construct localized electromagnetic modes by introducing defects in the periodic structure. These confined modes could be used as optical resonators, laser cavities being the most obvious application. In this seminar, I will discuss a theoretical approach for calculating the photonic structure of defects in 2D photonic crystals. The central feature of this approach is the construction of a basis set of local vector Wannier functions from the perfect crystal eigenstates. It has been proposed [1] that this basis be used to expand photonic crystal defect states analogous to the famous expansion in linear combinations of atomic orbitals of the electronic structure of the ideal silicon vacancy [2]. These approaches rely on a small number of basis states local to the defect region. In this work, we replace the fourier expansion of the perfect crystal by a real-space description in vector finite-elements. This method allows the computation of the Wannier basis on the same grid used to compute the perfect structure and results in a straightforward defect eigenvalue problem. I will present results that verify the eigenmodes of the crystal and examine the physics of selected defect modes.


[1] K.M. Leung, J. Opt. Soc. Am. B 10, 303 (1993).
[2] G.A. Baraff and M. Schluter, PRL 41, 892 (1978); J. Bernholc, N.O. Lipari, and S.T. Pantelides, PRL 41, 895 (1978).


Monday
**October 24, 2005**
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326