Abstract Submitted
for the OSF13 Meeting of
The American Physical Society

Band Structure in ZnO Based 3D Photonic Crystals DONALD PRIOUR, Youngstown State University — We calculate the band gap and dispersion curves for photonic crystals comprised of hexagonal arrays of ZnO nano-pillars with a periodic modulation of the refraction index along the axis of the pillars. Length scales of the intra-pillar refraction index variations and the unit cell of the underlying hexagonal lattice are in the optical range, on the order of 500 nm. We calculate photonic dispersion curves with a perturbative analysis where multidimensional integrals arising in the Rayleigh-Schrödinger series are evaluated using adaptive Monte Carlo sampling in conjunction with a Fourier decomposition in the Brillouin Zone to mitigate singularities at the Brillouin zone boundaries. The Fourier decomposition also yields band frequencies throughout the Brillouin Zone with the same series. Results are validated by comparison with band structures obtained from an alternative technique for special lattice geometries. Parameters such at the pillar radius, the hexagonal lattice unit cell size, and the wavelength and amplitude of the refraction index modulations are varied to investigate the effect on salient features of the band structure such as the mean width and uniformity of the band gap.

Donald Priour
Youngstown State University

Date submitted: 13 Sep 2013 Electronic form version 1.4