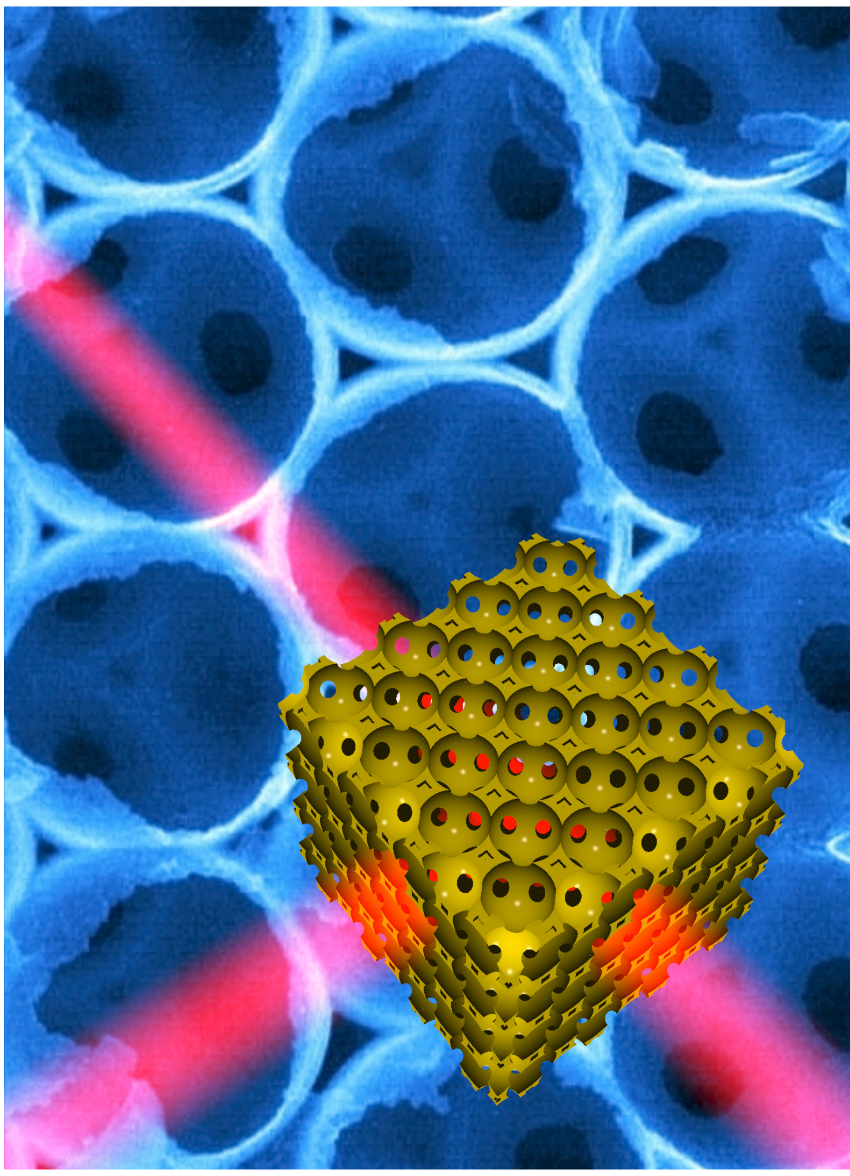
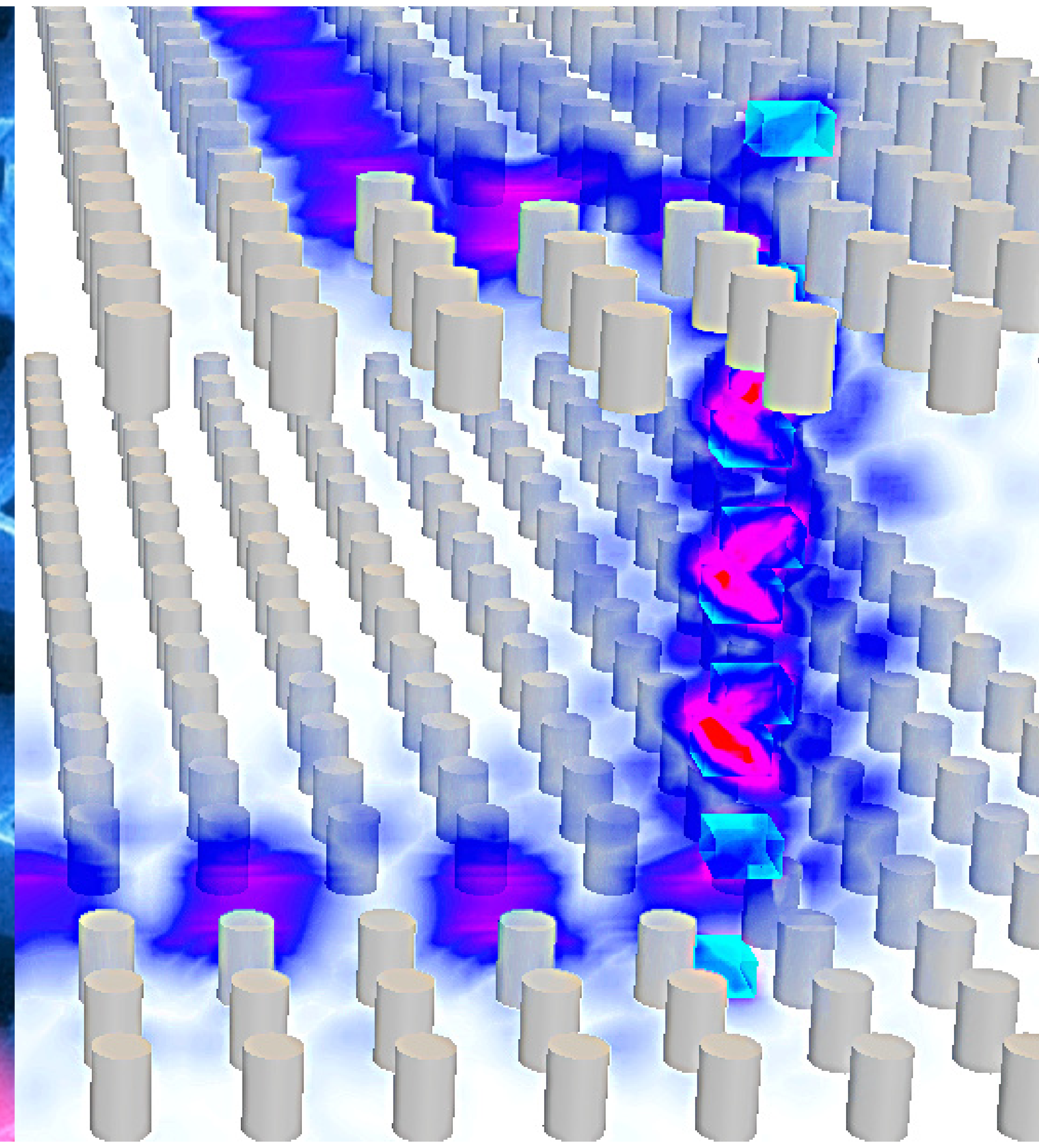
Boston University Physics Colloquium





Photonic Band Gap Materials: Light Trapping Crystals

Photonic Band Gap (PBG) materials are artificial, periodic, dielectrics that enable engineering of the most fundamental properties of electromagnetic waves. These include the laws of refraction, diffraction, and spontaneous emission of light. Unlike traditional semiconductors that rely on the propagation of electrons through an atomic lattice, PBG materials execute their novel functions through selective trapping or "localization of light". This is a fundamentally new and largely unexplored property of Maxwell's equations. This is also of practical importance for all-optical communications, information processing, efficient lighting, and solar energy trapping. Three dimensional (3D) PBG materials offer a unique opportunity to simultaneously (i) synthesize micron-scale 3D circuits of light that do not suffer from diffractive losses and (ii) engineer the electromagnetic vacuum density of states in this 3D optical micro-chip. This combined capability opens a new frontier in integrated optics as well as the basic science of radiation-matter interactions. I review recent approaches to micro-fabrication of photonic crystals with a large 3D PBG centered near 1.5 microns. These include direct laser-writing techniques, holographic lithography, and a newly invented optical phase mask lithography technique. I discuss consequences of PBG materials in classical and quantum electrodynamics.

Sajeev John
University of Toronto

October 27, 2009 (Tuesday) at 3:30pm (Refreshments at 3:15pm)
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Host: Shyamsunder Erramilli