

# **Photonic Band Gap Materials: Engineering Light-Matter Interactions**

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I review recent developments in micro-fabrication of 3D photonic band gap (PBG) materials and theoretical predictions for guiding light through air-waveguides in a 3D optical micro-chip. 2D paradigms are presented for (i) broadband coupling of light to such a micro-chip from photonic crystal fibers, (ii) one-way waveguiding in magnetic PBG materials, and (iii) quantum dot based all-optical switching. I describe electromagnetically- induced anomalous mobility of long-lived excitons in the "colored vacuum" of a 3D PBG-quantum well hetero-structure.