Optical Experiments on 3D Photonic Crystals

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ABSTRACT

Photonic crystals are optical materials that have an intricate structure with length scales of the order of the wavelength of light. The flow of photons is controlled in a manner analogous to how electrons propagate through semiconductor crystals, i.e., by Bragg diffraction and the formation of band structures. If the interaction between light and matter is made strong, multiple diffraction and multiple scattering effects dominate. A main research goal is the realization of a "photonic band gap", that is, a frequency range for which no light can propagate in a crystal in any direction, which causes radical modifications of the density of radiative states. Important consequences of photonic band gaps are the complete control over spontaneous and stimulated emission of light, as well as over the propagation of light, in particular photon localization. This opens up the possibility to achieve a "cage for light": trap photons and do with them whatever one chooses. In this talk we will also review means for making such structures, and recent experimental advances in optical experiments.