SNOM for the optical characterization of photonic crystals structures

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The characterization methods by classical microscopy are not well adapted to the study of photonic crystals structures because of their lack of resolution due to diffraction. Scanning Near-field Optical Microscopy (SNOM) appears like a unique way of characterization since it allows a local mapping of the electromagnetic field of a component under working conditions, with a resolution less than the wavelength. These field maps make it possible to detect the defects and make a return on the technology and the design in order to optimise the devices.

In this work, we analyse the guided light within the basic building blocks of photonic crystals-based optical circuits on SOI, working in telecom wavelengths (1.3-1.6 µm). We will present results on various devices: a W1 guide, a 60°-bended W1 guide and a Y-junction. SNOM observations show the apparition of standing waves in the photonic crystals guides. Realizing a Fourier transform and applying a high pass filter to the optical image, we can highlight the presence of the Bloch wave propagating in the guides.

Purcell Enhanced and Inhibited Emission in 3D Photonic Crystals

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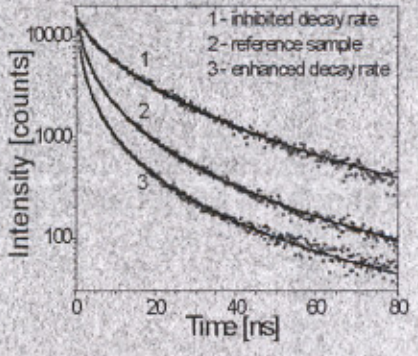
Control over spontaneous emission of light is essential to quantum optics and to diverse applications such as miniature lasers, LEDs, and single-photon sources for quantum information. We present experiments on emission from CdSe quantum dots (QDs) in 3D inverse opals. In time-resolved experiments, we observe that the photonic crystals control the emission decay rate of the QDs, demonstrating both broadband inhibition and enhancement [1]. For the first time we successfully interpret the emission dynamics of an *ensemble* of emitters (see Fig.): decay curves are modelled with a distribution of decay rates (curves). From this analysis we conclude that individual QDs experience even larger decay-rate modifications than the ensemble average.



[1] *Nature* **430**, 654 (2004); arxiv.org/physics/0410056.