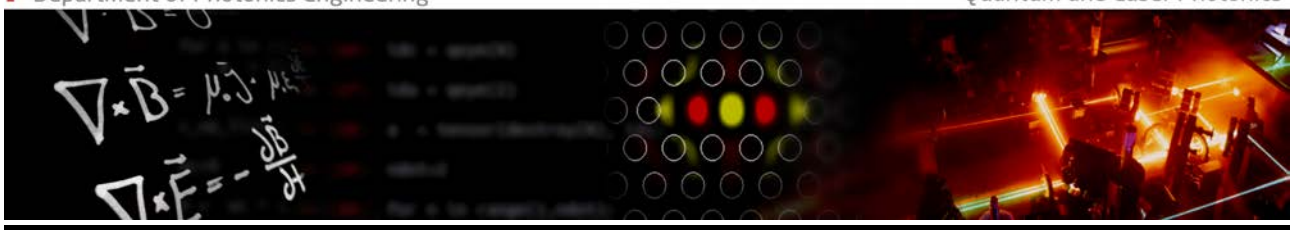

B.Sc or M.Sc. project

All-optical phase modulators using coupled-photonic crystal cavities

Phase modulators are one of the key components of today's optical communication. They can, for example, be used for generating signals at new freqeuncies for dense wavelength division multiplexing (DWDM) transmission. Apart from optical communication they can also be used in optical metrology for accurate and contactless distance measurements.

In this project, ultra-compact high-speed and low-energy optically controlled phase modulators will be designed. Starting from the fundamental understanding of a cavity-waveguide system, a numerical model based on coupled-mode theory [1] will be developed. Depending on interest and progress, proof of concept experimental investigations will be facilitated and performed.

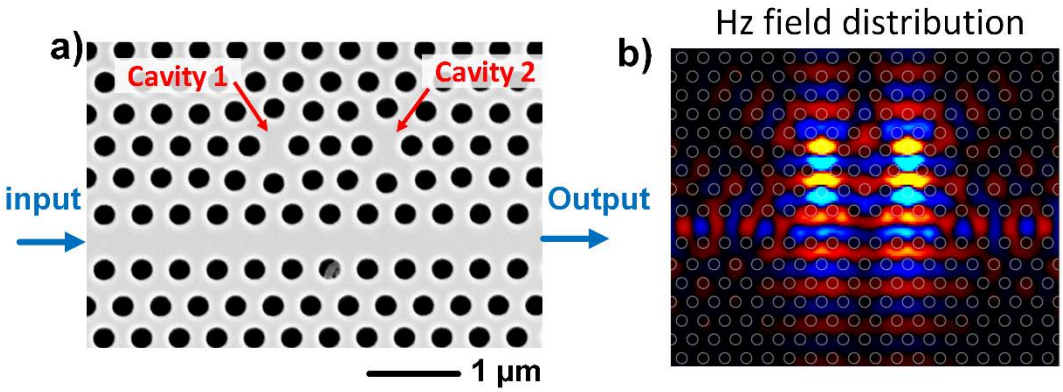

Fig. 1: (a) scanning electron microscope image of two coupled photonic crystal point defect nanocavities and a line-defect photonic crystal waveguide for injecting light into and out of the cavities. (b) Finite difference time domain (FDTD) simulated field distribution of the magnetic field component in the out-of-plane direction.

Two single-mode cavities which are evanescently coupled will be designed with unity transmission at the resonance frequency of the coupled system [2, 3]. The input signal at the resonance frequency will, however, experience a phase shift due to the coupled-cavity system. This phase change at unity transmission will be exploited as a ultrafast and compact phase modulator for optical communication.

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