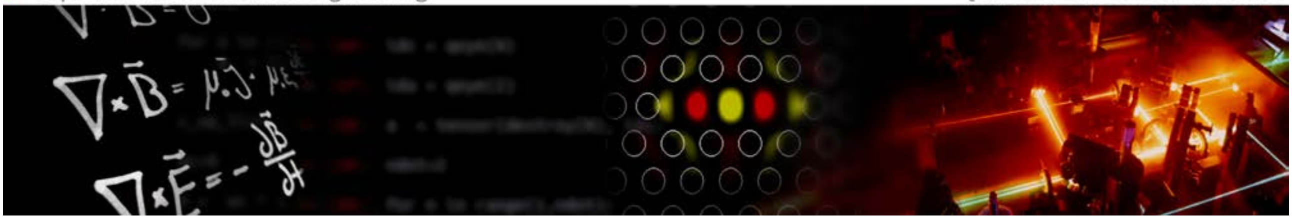

B.Sc or M.Sc. project

Dual Fano resonances for high speed optical communications

As electronics in modern computers are forced to operate at ever-higher frequencies, power dissipation and consequent hardware heating due to resistive loss in metal are becoming serious problems, which considerablely limits the data processing speed and causes high energy consumption. This drives the motivation of scientists to design efficient all-optical switches where one light controls another, which in priciple may avoid the physical limitations of metalic wires.

In this project, you will be investigating a cavity-waveguide system based on photonic crystal membrane platform which supports two Fano resonances. One resonance will be used for controlling the other resonance. The steep slope of Fano resonances makes it possible for extremely efficient all-optical switching on photonic chip. Recently, the interesting physics of Fano resonance enabled experimental demonstration of ultrafast optical switches [1] and self-pulsing nanolasers [2].

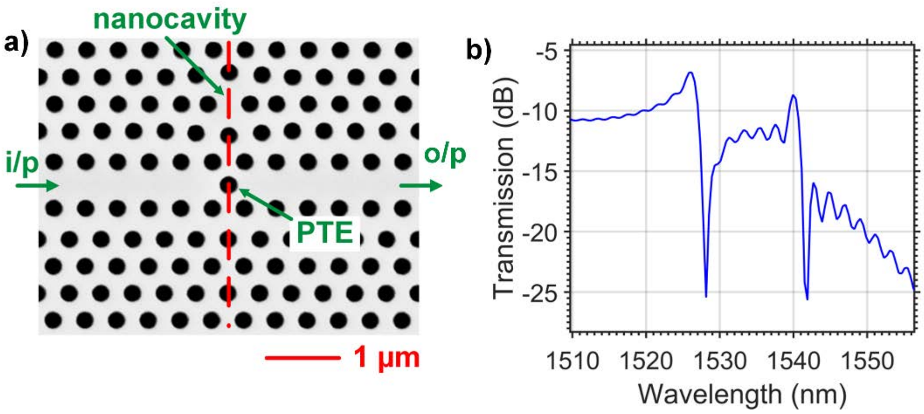

Fig. 1: (a) Scanning electron microscope image of a point defect nanocavity side-coupled to a line-defect photonic crystal waveguide. (b) Finite difference time domain (FDTD) simulated transmission spectrum of the device in part (a).

The discrete modes of the nanocavity and the continuum modes interfere to create Fano resonances [3] shown in Fig. 1 (b). As opposed to the scheme in [1], in this approach: the pump and data signals will be sufficiently separated in spectrum by placing them at the two resonances. This will effectively avoid signal crosstalk and hence enable high speed optical communication.

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References:

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