Light Force Silicon Devices

Mo Li, W. H. P. Pernice, Hong Tang
Yale University, New Haven, CT 06520

Nanomechanical devices and photonic devices are promising alternatives to today's electronic devices. We demonstrate the convergence of silicon nanomechanics and nanophotonics by building a new class of novel silicon optomechanical devices that operate on optical forces.[1] In macroscopic world, optical forces are generally thought to be too weak for practical use. This picture changes when applied to lightweight nanoscale devices in which optical fields are also tightly confined. In this talk, we demonstrate that significant optical force can be produced by a single pass of light in a silicon photonic circuit. This optical force, originated from lateral photon confinement rather than from momentum transfer, is applied in a planar geometry and offers high scalability. Practical application enabled by this strong mechanics-photonics interaction, such as all-optical logic, reconfigurable photonics, mechanical nonlinear optics, ultrasensitive transducers, will be discussed.

[1] Mo Li, W. H. P. Pernice, C. Xiong, T. Baehr-Jones, M. Hochberg, H. X. Tang, "Harnessing optical forces in integrated photonic circuits", Nature 456, 480(2008).

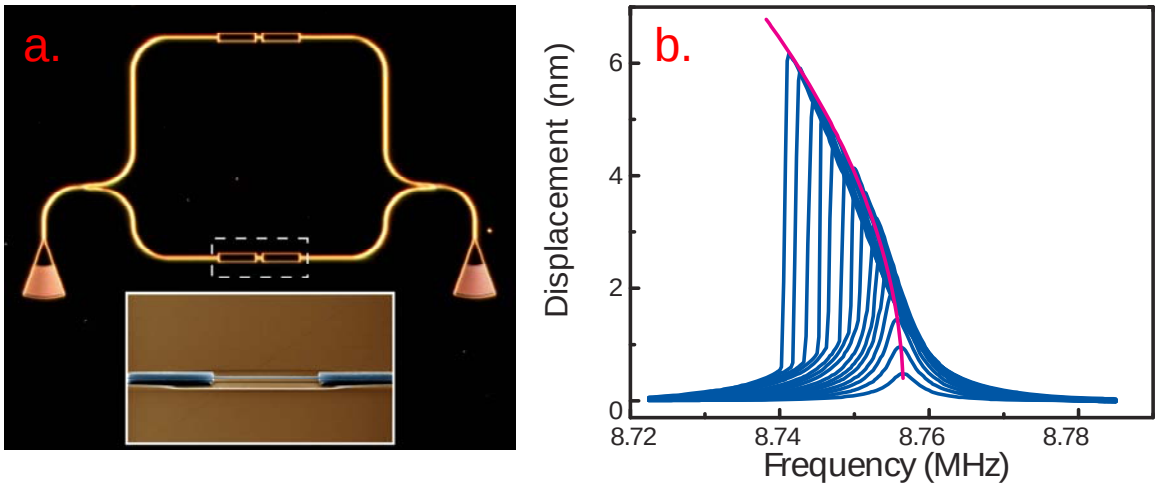

Figure 1. Integrated silicon optomechanical devices. A free-standing nanomechanical device (inset) is embedded in a photonic circuit, which supplies light force to actuate the nanomechanical resonator. The on-chip Mach-Zehnder interferometer provides sensitive readout of the optical forces.