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Robust 2D photonic crystals with high photon-phonon cooperativity

Abstract :

Cavity Optomechanics studies the interaction of photons with phonons at the quantum level. 1D Silicon photonic crystals have shown passive ground-state cooling and experiments such as phonon counting, thanks to respectively a high mechanical frequency of ~5GHz and a strong vacuum coupling rate (g0 ~ 2*pi*1MHz). However they are limited to pulsed operation, because of their low thermal conductivity. A 2D-design has been proposed to improve heat performance, but suffered from much lower coupling and low yield of successful device, since it was very dependent on fabrication errors. I will present a new 2D device, with a delocalized mechanical mode, improving the overlap of mechanical and optical modes, while being at the same time less sensitive to imperfections. This design could potentially lead to experiments with cooperativity bigger than 1 in continuous wave regime, allowing experiments requiring more statistics, such as single phonon Fock state heralding, to be performed in a resonable amount of time.