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Optomechanical metamaterials controlled by fiber Fabry-Perot cavities

Background: Micro-mechanical resonators are key components in modern communication technology. They find application as sensors in micro-electro-mechanical systems but are also candidates for emerging challenges like quantum coherent microwave-to-optical signal transduction and in quantum sensing. Efficient interfacing with optical means is performed using miniaturized optical resonators. There, the photons inside an optical resonator interact with the mechanical element through the radiation pressure that they exert onto it [1].

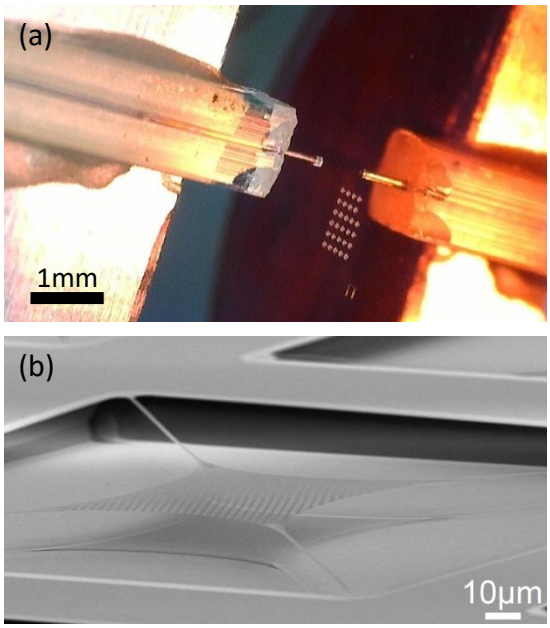

Figure 1 (a) An optical fiber mirror is approached to mechanical structures on a highly reflective substrate. The fiber mirror together with the substrate forms a miniaturized Fabry-Perot resonator. (b) Trampoline mechanical resonator from InGaP with photonic crystal pattern [5].

Goal of this project: We want to set up a miniaturized fiber-based Fabry-Perot cavity [2] combined with high quality mechanical resonators that are fabricated in the MC2 cleanroom. This will enable a high precision read-out of the mechanical resonator in vacuum and allow its manipulation by the optical field [3,4]. The setup will subsequently be used for our experiments on quantum sensing of high Q mechanical resonators and on optically tuned mechanical metamaterials.

What will you learn/get?

- Physics of micro-mechanical resonators and their interaction with light.
- Set-up of fiber-optic and fiber cavity experiments, vacuum experiment techniques.
- Research in a stimulating environment.

References

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