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Department of Microtechnology and Nanoscience (MC2)

Master thesis project

A fiber cavity for quantum optomechanics

Background Fiber-mirror cavities combine high-finesse optical confinement with small optical mode volumes (Fig.1). These properties make fiber cavities particularly attractive for cavity optomechanics, where the interaction between the optical field and mechanical motion can be exploited for sensing, cooling, and control of mechanical resonators. To maintain a stable optical resonance, the cavity length must be actively controlled. A common approach is the Pound–Drever–Hall (PDH) locking technique (Fig.2), which generates an error signal from the reflected laser light and uses feedback to suppress cavity-length fluctuations and stabilize the laser–cavity detuning

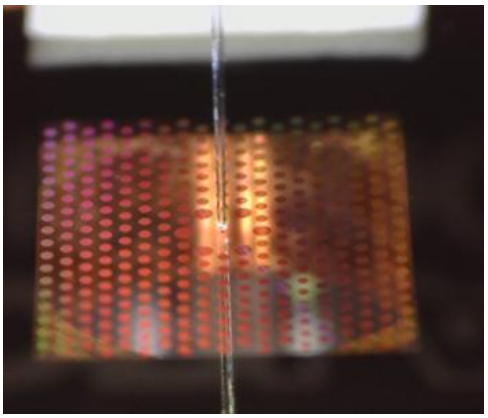

Fig. 1 Fiber mirror and a frequency-dependent mirror

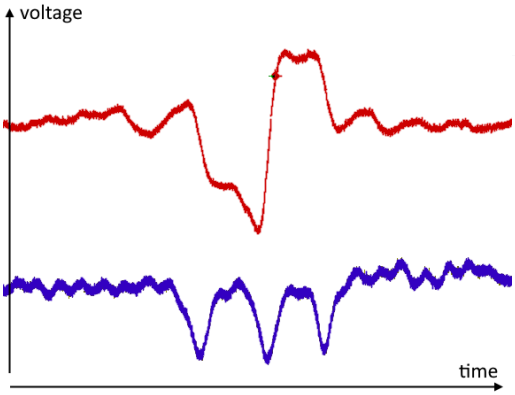

Fig. 2 PDH error signal in red and cavity dip with modulation sidebands in purple

Master thesis project

The project consists of

- Setting up a high-finesse cavity in the HV environment
- Forming a high-finesse cavity between a highly frequency-dependent mirror and a fiber mirror
- Characterization of reflection and transmission
- Stabilization of the fiber-cavity for PDH locking
- Calibration of the instruments
- Measuring optomechanical coupling

What will you learn

- Fiber optics
- Alignment procedure with optical components
- Locking techniques
- Physics of photonic crystals
- Fundamentals of optomechanics
- Teamwork in a stimulating research environment

Questions? Contacts:

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