SFB/TRR 21 - Colloquium

8. Juli 2016, Stuttgart

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Diamond nanophotonic optomechanical devices: towards coupling photons, phonons and spins

Optomechanical devices enhance the optical radiation pressure induced interaction between light and mechanical resonances. This interaction can be harnessed to enable coherent conversion of light to mesoscopic phonons of nanomechanical resonators with frequencies ranging from kHz to GHz. Through control of these phonons, it is anticipated that new approaches for manipulating and coupling the electronic states of solid state spin systems such as the diamond NV center are feasible. However, until recently creating optomechanical devices from high quality diamond chips has been an outstanding challenge. In this talk I will present our recent advances in creating optomechanical devices from single crystal diamond material, including diamond waveguides with strong dissipative optomechanical coupling [1], and microdisks supporting mechanical resonances with a desirable combination of low dissipation and high frequency, as well as strong optomechanical coupling [2]. I will then discuss prospects for optomechanically coupling these resonances to diamond NV centers.

[1] B. Khanaliloo, H. Jayakumar, A. C. Hryciw, D. Lake, H. Kaviani, P. E. Barclay, Single crystal diamond nanobeam waveguide optomechanics, Physical Review X 5 041051 (2015),

[2] M. Mitchell, B. Khanaliloo, D. Lake, P. E. Barclay, Low-dissipation cavity optomechanics in single crystal diamond, submitted (2015), pre-print: arxiv:1511.04456

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