



**Sonderforschungsbereich 631**  
Festkörperbasierte Quanteninformationsverarbeitung



## **SEMINARANKÜNDIGUNG**

**Donnerstag, 13. Dezember 2007, 10.30 Uhr**

**Physik-Department E11, Seminarraum 127 (Physik II)**

### **“Towards cavity Quantum Optomechanics with Monolithic Microresonators”**

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Achieving the quantum regime with mechanical objects offers fascinating possibilities for applied and fundamental Physics alike – yet has been unattained so far. Remarkably, research groups working on mechanical systems ranging in size from nanometer-scale oscillators to centimeter-scale optical cavities to kilometer-scale gravity wave detectors are now all independently approaching a regime in which either the mechanical system or its interaction with the environment must be described quantum mechanically. These experiments will mark the beginning of the new research field of *cavity Quantum Optomechanics*. In this talk I will review our own efforts at the MPQ in this emerging research field; specifically, we have developed a novel laser cooling method (1,2) with which mechanical oscillators can be cooled - analogous to atomic laser cooling - and achieved unprecedented readout of mechanical motion. This technique provides a route towards ground state cooling of a mechanical oscillator. The mechanical oscillators in our work are provided by monolithic micro-cavities, which inherently combine mechanical and optical degree of freedom. I will describe the various efforts my group made towards achieving this interesting, yet highly challenging regime. Finally, I will conclude the talk with other applications of ultra-high-Q monolithic microresonators presently studied at the MPQ, namely monolithic optical frequency comb generation(3) and molecular recognition.

#### ***References:***

- (1) A. Schließer, P. Del'Haye, N. Nooshi, K. J. Vahala and T. J. Kippenberg, Physical Review Letters 97, 243905 (2006)
- (2) I. Wilson-Rae, N. Nooshi, W. Zwerger and T.J. Kippenberg, Physical Review Letters 99, 093901 (2007)
- (3) P. Del'Haye, A. Schließer, O. Arcizet, T. Wilken, R. Holzwarth, and T.J. Kippenberg, To be published, Nature (2007)