

Prize Talk PV VII Wed 13:00 HSZ 01
Optomechanics — ●FLORIAN MARQUARDT — Department of Physics, Center for NanoScience, and Arnold Sommerfeld Center for Theoretical Physics, Ludwig Maximilians Universität München, Theresienstrasse 37, 80333 München — Träger des Walter-Schottky-Preises

In this talk I will review recent progress in understanding the physics of the interaction between radiation and mechanical motion. The paradigmatic system in this field of 'optomechanics' consists of an optical cavity with a movable mirror attached to a cantilever. I will discuss how the coupled dynamics of the light field inside the cavity and the cantilever motion gives rise to a series of interesting effects. On

the level of classical dynamics, I will present the theory of nonlinear oscillations and the corresponding attractor diagram. Furthermore, it is possible to cool the cantilever by irradiating the cavity with a red-detuned laser beam. I will present the quantum theory of optomechanical cooling and discuss the prospects for reaching the ground state of the cantilever's center-of-mass motion. This could open the door to the observation of quantum jumps between Fock states of a macroscopic object, and I will illustrate this by presenting a setup where a quantum-non-demolition measurement of the cantilever's phonon number could be achieved. Finally, I comment on the opportunities opened up by various recent developments in this field, such as the connection with cold atom physics.