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Quantum Optics, Quantum Nanophysics & Quantum Information

IQOQI

Institut für Quantenoptik und Quanteninformation

INVITATION

to a talk given by

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Cooling Polarisable Particles with an Optical Memory

Abstract :

Most optical cooling methods---optical molasses being the prototypical example here---have traditionally relied on the resonant enhancement of forces originating in the Doppler shift. Systems, such as simple mirrors, that demonstrate no such resonance cannot be cooled as easily. Several approaches to solve this problem involve the use of cavities. Our approach is to look at a cavity interacting with an optomechanical system as an \emph{optical memory}, which introduces a non-Markovian, or time-delayed, component in the forces acting on the system.

We first look at what we call `mirror mediated cooling', where a point polarisable particle (an atom, say, or a micromirror) interacts with its time-delayed reflection in a mirror and thereby experiences a cooling force---the memory here consists of a long time delay between the particle and the mirror. Such a long delay line is not experimentally desirable, and we can significantly improve the system by replacing it with another well-known memory element: a Fabry--Perot cavity. This `external cavity cooling' scheme is different from standard cavity mediated cooling techniques in that the particle sits outside the cavity. We analyse this new system using a simple, but surprisingly useful, model grounded in classical electrodynamics and show that, even with the particle outside the cavity, the force acting on it is amplified by a factor of the order of the cavity finesse.

Possible realisations of this scheme range from relatively simple modifications to existing optomechanical experiments, essentially adding a second fixed mirror, to the use of more exotic structures possessing strong plasmon resonances to generate the required optical delay.

Tuesday, 15th June, 2010
11:00 s.t.

Seminar Room 2.08, IQOQI, Boltzmanngasse 3, 1090 Wien

Hosted by: Prof. Markus Aspelmeyer