QUANTUM OPTICS SEMINAR

Title: Preparing and probing a single atom in a microscopic dipole trap

Speaker: Andrew Hilliard
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Time: Tuesday, May 10 at 15:15

Room: 1525-323

Abstract:

Neutral atoms stored in optical traps provide a versatile platform for fundamental studies of quantum mechanics at the single event level and have potential for application in quantum information processing. Far off-resonance optical traps provide conservative potentials and excellent isolation from the environment, and they may be arranged to produce arbitrary arrays of traps, where each trap is occupied by a single, individually addressable atom. A major challenge associated with this approach is the reliable generation of single atom occupancy in each trap. In this talk, I report a loading efficiency of 82.7% in a microscopic dipole trap – a so-called microtrap. This is achieved by manipulating the collisions between pairs of trapped atoms through tailored optical fields and directly observing the resulting single atoms.

I will also describe the fluorescence imaging technique with which we can count up to several atoms in the microtrap. This technique uses a standing wave of laser light that is blue-detuned from resonance for an atom at the centre of the microtrap. The blue detuning limits trap-loss from inelastic light-assisted collisions and the optical standing wave induces a spatial modulation of the imaging beam intensity, leading to a form of Sisyphus cooling. Unlike other forms of blue-detuned laser cooling, this mechanism does not pump the atom(s) into optically dark states, making it suitable for fluorescence imaging.

Michael Drewsen

Coffee, tea and cake from 15.05