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Imaging of Multi-Level Atoms in Deep Optical-Micro Traps[1]
TZAHI GRUNZWEIG, ANDREW HILLIARD, MATT MCGOVERN, PETER MCDOWALL, MIKKEL F. ANDERSEN, University of Otago — By tightly focusing a far off-resonance laser beam, we can form an optical dipole trap with large oscillation frequencies. Such systems are desirable both for applications in quantum information processing [1] and for investigating quantum mechanics at the single event limit [2]. Our setup is based on the atomic tweezers concept, in which an objective lens is used both to focus the trapping beam, and to image the fluorescence from the trapped atoms. In this talk I will describe our experimental setup and present our recent results on efficient detection and imaging of dense samples of Rb85 atoms in the micro-trap. We address imaging issues resulting from the multi-level structure of the atoms, the different shifts to the various internal states induced by the trapping beam and various loss mechanisms associated with the on-resonance detection process. Detailed understanding of the in-situ detection processes may allow for loss-free, number counting of the trapped atoms. [1] A. Gaëtan et. al. Nature Physics 5, 115 - 118 (2009); E. Urban et. al., Nature Physics 5, 110 - 114 (2009). [2] Th. Sauter et. al., Phys. Rev. Lett. 57, 1696 - 1698 (1986).

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