DAMOP13-2013-000476

Abstract for an Invited Paper
for the DAMOP13 Meeting of
the American Physical Society

Coherent manipulation of cold cesium atoms in a nanofiber-based two-color dipole trap

CLEMENT SAYRIN, Vienna Center for Quantum Science and Technology, TU Wien, Atominstitut

We have recently demonstrated a new experimental platform for trapping and optically interfacing laser-cooled cesium atoms [1,2]. The scheme uses a two-color evanescent field surrounding an optical nanofiber to localize the atoms in a one-dimensional optical lattice 200 nm above the nanofiber surface. In order to use this fiber-coupled ensemble of trapped atoms for applications in the context of quantum communication and quantum information processing, non-classical states of the atomic spins have to be prepared and should live long enough to allow one to apply successive quantum operations. However, the close proximity of the trapped atoms to the nanofiber surface and the strong polarization gradients of nanofiber-guided light fields are potentially important sources of decoherence. In this talk, I will present our latest experimental results on characterizing the coherence properties of atomic spins in our nanofiber-based trap. Using a microwave field to drive the cesium clock transition, we determine inhomogeneous and homogeneous dephasing times by Ramsey and spin echo techniques, respectively, and identify the sources of the measured decoherence. Our results constitute the first measurement of the coherence properties of atoms trapped in the vicinity of a nanofiber and represent a fundamental step towards establishing nanofiber-based traps for cold atoms as a building block in quantum networks.

[1] E. Vetsch *et al.*, Phys. Rev. Lett. **104**, 203603 (2010).
[2] S. T. Dawkins *et al.*, Phys. Rev. Lett. **107**, 243601 (2011).