Abstract Submitted
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Analysis of a state-insensitive, compensated nanofiber trap[1] C. LACROUTE, K.S. CHOI[2], A. GOBAN, D.J. ALTON, D. DING, N.P. STERN[3], H.J. KIMBLE, California Institute of Technology — Laser trapping and interfacing of laser-cooled atoms in optical fiber networks is an important capability for quantum information science. Following the work of [1] and [2], we propose a method of trapping single Cesium atoms with a two-color, state-insensitive evanescent wave near a dielectric nanofiber. The vector light shifts induced by the ellipticity of the forward-propagating wave can be canceled by a backward-propagating wave. By operating the trap at magic wavelengths, we remove the differential scalar light shift between ground and excited states, allowing for resonant driving of the optical D2 transition. Tensor shifts are inherent to the D2 excited state 6P3/2, but vanish for the D1 excited state 6P1/2. We show that the proposed scheme of [3] can be translated to the Cs D1 line, reducing further the excited state splitting. These properties will enable quantum-state engineering in optical traps near microscopic optical waveguides and resonators, including for implementations of quantum memories, coupling of single atoms and ensembles to optical and mechanical resonators, and studying 1-D spin chains. [1] Balykin et al, PRA, 70(1):011401, 2004. [2] Vetsch et al, PRL, 104(20):203603, 2010. [3] Lacroute et al, New J. Phys. (in press); arXiv:1110.5372v1.

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