Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Magic wavelengths for optically trapped atoms BINDIYA ARORA, IISER Mohali, India, MARIANNA SAFRONOVA, University of Delaware, CHARLES CLARK, JQI, NIST and the University of Maryland — The ability to trap neutral atoms inside high-Q cavities in the strong coupling regime is of particular importance for quantum computation and communication schemes, where it is essential to precisely localize and control neutral atoms with minimum decoherence. In a far-detuned optical dipole trap, the potentials experienced by an atom in its ground and excited states may be of opposite sign affecting the fidelity of experiments in which excited states are temporarily occupied. "Magic wavelengths" are those for which such potentials are equal. Single-laser schemes offer few cases in which magic wavelengths exist for Rb [Arora et al. PRA 76, 052509 (2007).] Here we explore bichromatic schemes for state-insensitive optical trapping of the Rb. We describe the use of trapping and control lasers to minimize the variance of the potential experienced by a trapped Rb atom in ground and excited states. We have also identified wavelengths λ_{zero} where the ground state frequency-dependent polarizabilities in alkali-metal atoms are zero. These are relevant for cooling and trapping experiments involving mixtures such as Rb/Yb, where the vanishing lattice potential for Rb facilitates interesting applications.

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Date submitted: 19 Nov 2010 Electronic form version 1.4