Abstract Submitted
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Trapping atoms in a bottle beam generated by a diffractive optical element[1] V. IVANOV, J. ISAACS, M. SAFFMAN, University of Wisconsin, S.A. KEMME, G.R. BRADY, A.R. ELLIS, J.R. WENDT, Sandia National Labs — Highly excited Rydberg states have been used to demonstrate a neutral atom quantum gate, two-atom entanglement and hold promise for studies of surface potentials, such as the Casimir-Polder potential. Blue detuned Optical Bottle Beam (BoB) traps where atoms are confined in intensity minima trap both ground and Rydberg state atoms. This minimizes qubit decoherence and allows accurate measurements of the frequencies of the Rydberg transitions. We have generated optical bottle beam traps using a segmented diffractive optical element with π phase shift between the inner and outer regions. The idea for this trap follows the approach used by Ozeri, et al. Phys. Rev. A 59, R1750 (1999) but integrates the phase shift and focusing lens into a single diffractive element fabricated at Sandia National Lab. Measured profiles of the trap light intensity are compared with numerical predictions using a Fresnel diffraction code. Progress towards atom trapping in the bottle for studies of atom-surface interactions will be presented.

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