Abstract Submitted
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Three dimensional projection cooling[1] XIAO LI, KARL D. NELSON, AMITA B. DEB, DAVID S. WEISS, Pennsylvania State University — We have significantly improved the laser cooling of single atoms trapped in a 3D optical lattice with 5 μm spacing. We use microwaves to drive lower sideband transitions between two spin states, whose spatial wavefunctions are temporarily displaced by a small lattice polarization rotation. Subsequent optical pumping completes a cooling cycle in one dimension, similar to Raman sideband cooling, but without the Raman beams [1]. We perform this cycle for each spatial direction, and repeat the process 30 times. The final vibrational excitation is below $0.2h\nu$ in each direction, despite the Lamb-Dicke parameter being a relatively high $\eta = 0.37$. We will also discuss our progress on performing arbitrary single qubit rotations on a target atom without affecting its neighbors. These are both important elements in the development of a site-addressable neutral atom quantum computer.

[1] Leonid Forster, *et al* PRL 103, 233001 (2009)

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