Abstract Submitted
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Single qubit gates in a 3D array of neutral atoms[1] THEODORE A. CORCOVILOS, YANG WANG, XIAO LI[2], DAVID S. WEISS, The Pennsylvania State University, Dept. of Physics, JUNGSANG KIM, Applied Quantum Technologies and Duke University, Dept. of Electrical and Computer Engineering — We present an approach to quantum computing using single Cs atoms in a cubic 5-μm spaced 3D optical lattice. After cooling the atoms to near their vibrational ground state (76% ground state occupancy) using projection sideband cooling, we manipulate the state of individual atoms using the AC Stark shift induced by intersecting lasers and microwave pulses that are only resonant with the shifted atom. Here we demonstrate Rabi oscillations of a single atom in the center of the array and progress towards steering the beams to address the other atoms. Rapid steering of the lasers using micromirrors allows single-atom gates of $\sim$10 μs. This single-site addressing along with lattice polarization rotation will enable us to fill voids in the central region of the atom array by selectively moving individual atoms. Future work will couple adjacent qubits via the Rydberg blockade mechanism with expected two-qubit gate times of $\sim$100 ns.

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