Abstract Submitted
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A single qubit gate with single neutral atoms in a 3D optical lattice[1] YANG WANG, THEODORE A. CORCOVILOS, DAVID S. WEISS, The Pennsylvania State University, Dept. of Physics — We present a quantum computing experiment using individual Cs atoms in a 5 μm-spaced 3D optical lattice as qubits. We can select a single atom in a 5×5×5 array by crossing two perpendicular far-off-resonance addressing beams at the target atom. The addressing beams minimally affect the mF=0 qubit states, but they AC Stark shift the mF=1 sublevels of the target atoms by at least twice as much as adjacent atoms. Microwave pulses can then be applied that are only resonant with the target atom. The addressing beams can be steered to any site in the array using MEMS mirrors within 10 μs, allowing for arbitrary single qubit gates in $\leq$ 100 μs. Future work will involve selectively moving atoms around to fill vacancies by translating a state-dependent optical lattice and entangling adjacent atoms via the Rydberg blockade mechanism.

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