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Imaging single atoms in a three dimensional array[1]

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We have demonstrated trapping and imaging of 250 single atoms in a 3D optical lattice. The 5 micron lattice spacing is large enough that individual atoms can be addressed using lasers and microwaves in a way that does not affect the quantum coherence of other atoms. Our goal is to use these trapped atoms as qubits. So far, we fill a random half of the lattice sites, but a combination of site-selective state changes and state-selective lattice translations should allow us to verifiably fill all vacancies. We will describe our experiments to date and our plans for entangling atoms and implementing a neutral atom quantum computer. Our lattice can readily be scaled to include thousands of trapped atoms. This work was performed in collaboration with Karl Nelson and Xiao Li.

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