Abstract Submitted
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A reconfigurable blue-detuned lattice for neutral atom quantum computing[1] TRENT GRAHAM, CODY POOLE, XIAOYU JIANG, ALPHONSE MARRA, BRANDON GRINKEMEYER, GARRETT HICKMAN, University of Wisconsin - Madison, JOSH CHEREK, ColdQuanta, MATTHEW EBERT[2], MARK SAFFMAN, University of Wisconsin - Madison ColdQuanta — We present recent progress towards building a neutral atom quantum computer. We use a new design for a blue-detuned optical lattice to trap single Cs atoms. The lattice is created using a combination of diffractive elements and acousto-optic deflectors (AODs) which give a reconfigurable set of cross-hatched lines. By using AODs, we can vary the number of traps and size of the trapping regions as well as eliminate extraneous traps in Talbot planes. Since this trap uses blue-detuned light, it traps both ground state atoms and atoms excited to the Rydberg state; moreover, by tuning the size of the trapping region, we can make the traps "magic" for a selected Rydberg state. We use an optical tweezer beam for atom rearrangement. When loading atoms into the array, trap sites randomly contain zero or one atoms. Atoms are then moved between different trapping sites using a red-detuned optical tweezer. Optimal atom rearrangement is calculated using the "Hungarian Method". These rearrangement techniques can be used to create defect-free sub-lattices. Lattice atoms can also be used as a reservoir for a set of selected sites. This allows quick replacement of atoms, and increased data rate, without reloading from a MOT.

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