

Abstract Submitted  
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**Exploring a neutral-atom SWAP gate with clock states** NATHAN LUNDBLAD, PATRICIA LEE, JOHN OBRECHT, WILLIAM PHILLIPS, TREY PORTO, National Institute of Standards & Technology — Recent work in our group demonstrated the essential components of a neutral-atom  $\sqrt{\text{SWAP}}$  gate using exchange oscillations in a dynamically-deformable double-well optical lattice. This result demonstrated the feasibility of quantum gates driven by controlled exchange interactions. The observed oscillations, while long-lived, had limited contrast due to a multitude of experimental issues. We have moved our operating qubits from the  $|F = 1, m_F = -1\rangle, |F = 1, m_F = 0\rangle$  pair to the hyperfine clock state, eliminating considerable concern over magnetic-field issues. We present observations of this improved operation, as well as exploration of stroboscopic deformation of the double-well lattice.

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