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^{87}Rb in a double well optical lattice IAN SPIELMAN, CHAD FERTIG, JOHNNY HUCKANS, JAMES PORTO, WILLIAM PHILLIPS, National Institute of Standards and Technology — Bose condensed alkali gasses present an ideal venue for the study of weakly interacting, phase coherent quantum phenomena. The subsequent application of an optical lattice can controllably increase the importance of interactions. Such a strongly interacting, yet tunable, system is interesting of its own right; consider for example the recent direct observation of a Mott insulator-superfluid transition. More practically, however, these strong interactions coupled with long coherence times, and easily tuned parameters suggest this system as a potential quantum information processor. In this talk, we first introduce a scheme for 2 qbit gates between pairs of ^{87}Rb atoms in a tunable double-well optical lattice. An external phase sets the barrier between wells and can be varied externally; thus, atoms in each well can be controllably interacted. Here we present preliminary experimental results demonstrating loading of the individual lattice sites, and comment on the effects of changing the barrier potential with the loaded atoms.

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