Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Quantum Information Processing with Two Atomic Species Confined in Independently Controlled Optical Lattices KATHY-ANNE BRICKMAN SODERBERG, ARJUN SHARMA, ANDREAS KLINGER, SKYLER DEGENKOLB, NATHAN GEMELKE, CHENG CHIN, Department of Physics and The James Franck Institute, The University of Chicago — We present progress toward scalable quantum information processing using fermionic ^{6}Li and bosonic ^{133}Cs each confined in an independently controlled optical lattice. The ^{6}Li atoms, loaded with one atom per site, act as quantum bits (qubits) to store information while ^{133}Cs, loaded with one atom per one hundred sites, is a messenger bit to mediate gate operations and carry entanglement between ^{6}Li qubits. We demonstrate the fabrication of identical and stable hexagonal optical lattices at 680nm for ^{6}Li and 1064nm for ^{133}Cs using a diffraction grating and common mode optics. Qubit operations are performed by spatially overlapping a messenger and qubit. This is done by phase shifting the lattices with an electro-optic modulator array that can either adiabatically shift an atom over one lattice site in 11μs, or rapidly shift the lattice in 100ns such that no atomic motion occurs. These two modes allow the messenger atom to "step" across the lattice to address any (distant) ^{6}Li qubit.

Kathy-Anne Brickman Soderberg
Department of Physics and The James Franck Institute,
The University of Chicago

Date submitted: 26 Jan 2010 Electronic form version 1.4