Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Controlled Interaction between Ultracold Lithium and Cesium Atoms in Optical Lattices for Quantum Information Processing KATHY-ANNE SODERBERG, Department of Physics and The James Franck Institute, The University of Chicago, ARJUN SHARMA, NATHAN GEMELKE, CHENG CHIN — We present progress on a quantum information processing experiment using degenerate gases of bosonic ^{133}Cs and fermionic ^{6}Li ,each confined in an independently controlled, overlapping optical lattice. An insulating state of ^{6}Li will prepare an initial state with exactly one atom per lattice site. These atoms serve as quantum bits (qubits). ^{133}Cs atoms are sparsely loaded into a second lattice, and act as messenger bits to carry entanglement between distant qubits. Qubit operations are mediated through magnetic dipole transitions to a ^{6}Li-^{133}Cs molecular state that is formed only when qubit and messenger are overlapped. The ^{133}Cs messenger atom can interact with (multiple and distant) ^{6}Li qubits through translation of the Cs lattice using an electro-optic modulator array, making this implementation scalable. We present progress on the first spectroscopy experiments of the ^{6}Li-^{133}Cs molecular states. These findings will guide the best strategies for implementing qubit operations using messenger atoms.

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

Date submitted: 14 Dec 2009 Electronic form version 1.4