Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Coherent Control of Atomic Transport in Spinor Optical Lattices[1]
BRIAN MISCHUCK, IVAN DEUTSCH, University of New Mexico, POUL JESSEN, University of Arizona — The coherent transport of atoms in optical lattices is essential for quantum computation and quantum simulations involving controlled collisions between the atoms. By applying the techniques of quantum control, we study protocols for evolving the motional wave function in the ground band using applied external fields, and well-designed lattices. Through a combination of spin dependent optical lattices, external gradients and microwave controls we can couple the atom's spin and motional degrees of freedom. Borrowing well developed ideas from the control of the atoms' spin allows us to explore the controllability of the spin and the spatial wavefunction jointly. We examine explicit constructions for synthesizing specific unitary maps. We also explore extensions for control of multiple particles or multiple bands.

[1]We acknowledge NSF grant 0555573.

Brian Mischuck
University of New Mexico

Date submitted: 23 Jan 2009 Electronic form version 1.4