Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Many-Body Entangled Quantum Dynamics of Ultracold Molecules in Optical Lattices MICHAEL WALL, LINCOLN CARR, Colorado School of Mines, COLORADO SCHOOL OF MINES TEAM — Dynamical aspects of quantum phase transitions have long been restricted to mean field considerations due to lack of numerical tools. With the recent advent of Time-Evolving Block Decimation (TEBD), an entangled quantum dynamics algorithm, fully quantum studies of the dynamical aspects of many-body systems are now amenable to study. We present entangled quantum dynamics studies of the *Molecular Hubbard Hamiltonian*, a novel lattice Hamiltonian which describes the essential many-body physics of closed-shell ultracold heteronuclear molecules in their absolute ground state in a quasi-one-dimensional optical lattice. This Hamiltonian is explicitly time-dependent, making a dynamic generalization of the concept of quantum phase transitions necessary. We demonstrate the presence of emergent time scales over which spatial entanglement grows, crystalline order appears, and oscillations between rotational states self-damp into an asymptotic superposition. We also demonstrate that these time scales are not, in general, monotonic functions of the parameters of the lattice.

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Date submitted: 22 Jan 2009 Electronic form version 1.4