Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Quasi steady-states, spin statistics, and interaction-induced transport of ultra-cold atoms in 1D optical lattices[1] CHIH-CHUN CHIEN, Los Alamos National Laboratory, MICHAEL ZWOLAK, Oregon State University, MASSIMILIANO DI VENTRA, University of California, San Diego — We consider several non-equilibrium scenarios where ultra-cold atoms are initially loaded into the ground state of a 1D optical lattice. The system is then set out of equilibrium either by inducing a density imbalance or by imposing time-dependent inhomogeneous interactions. To monitor the dynamics, we have implemented the micro-canonical approach to transport [1] which has been previously used to study electron dynamics in nanoscale systems. We have found that by removing particles on the right half of the lattice, fermions form a quasi steady-state current, which can be observed as a plateau in the current as a function of time. In contrast, the bosonic current oscillates and decays to zero in the thermodynamic limit [2]. The difference appears in uniform lattices as well as lattices with a harmonic trap. Further, when light-induced interactions are applied to half of the lattice, we have found, using a Hartree-Fock approximation, a conducting-nonconducting transition in the fermionic case as the interaction increases. Our studies are relevant to recent experiments on transport of ultra-cold atoms and address fundamental issues in nanoscale electronic transport.

[1] Di Ventra and Todorov,J. Phys. Cond. Matt. 16, 8025 (2004).
[2] Chien, Zwolak, Di Ventra, arXiv: 1110.1646.

[1]Work supported in part by DOE.

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Date submitted: 16 Dec 2011 Electronic form version 1.4