Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Geometric effects on quantum transport of ultracold atoms in optical lattices: Quantum acceleration and flat band CHIH-CHUN CHIEN, MEKENA METCALF, University of California, Merced, MASSIMILIANO DI VENTRA, University of California, San Diego, GIA-WEI CHERN, Los Alamos National Laboratory — The realizations of interesting optical lattices for ultracold atoms provide opportunities for investigating geometric effects on many-body physics. Thesquare, triangular, honeycomb, kagome lattices, and other geometries have been experimentally demonstrated. When the atoms are driven out of equilibrium by manipulations of the density or trapping potential, their quantum transport can be monitored and fundamental questions regarding transport in isolated systems can be addressed unambiguously. We found that the propagation velocity of the matter wave representing the flowing atoms can be accelerated by tuning the lattice geometry. This acceleration is a pure quantum effect because no shorter path is created as the geometry changes. For lattice geometries supporting a dispersionless flat band, the localized atoms in the flat band do not participate in transport but interfere with the mobile atoms. We found a generic insulating phase exhibiting a density jump in the profile that can be dynamically generated. Interesting spatial patterns may emerge if those flat-band lattices are manipulated, and an analogue of geometric frustration in quantum transport will be presented.

Chih-Chun Chien
University of California, Merced

Date submitted: 15 Jan 2015 Electronic form version 1.4