Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Exploring a geometry-induced phase transition from a superfluid to Mott insulating state in a tunable superlattice JENNIE GUZMAN, GYU-BOONG JO, CLAIRE THOMAS, PAVAN HOSUR, ASHVIN VISHWANATH, DAN STAMPER-KURN, University of California Berkeley — Ultracold atoms in optical lattices are a promising candidate for the simulation of condensed matter systems due to the fine control over interactions and geometries. Here we present experiments probing the Mott insulator phase transition in a two-dimensional bi-chromatic superlattice using ultracold ^{87}Rb atoms. The lattice consists of overlaying two commensurate wavelength triangular lattices. By adjusting the relative position of the two lattices, we are able to realize different lattice geometries, including the kagome, the one-dimensional stripe, and the decorated triangular lattice. The superlattice gives a new way to investigate the superfluid to Mott insulating phase transition beyond varying the ratio of the tunneling and interaction energies, J/U. Using this extra degree of control, we investigate a possible geometry-induced phase transition from a superfluid to a Mott insulating state by tuning the number of neighboring sites.

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Date submitted: 27 Jan 2012 Electronic form version 1.4