Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Towards two dimensional synthetic lattice of momentum states[1]
SHRADDHA AGRAWAL, SAI NAGA MANOJ PALADUGU, FANGZHAO ALEX AN, HANNAH JEAN MANETSCH, BRYCE GADWAY, University of Illinois at Urbana-Champaign — We describe progress towards an experimental platform for engineering two dimensional synthetic lattices based on laser coupled atomic momentum states of potassium-39 atoms. This technique allows for the local and time-dependent control over nearly all system parameters, including tunneling phases, which makes it suitable for studying a range of novel transport phenomena in two-dimensional lattices. We describe how an arrangement of three equally separated in-plane Bragg lasers can be used as a versatile setup for realizing triangular lattices, honeycomb lattices, Kagome lattices, and Hofstadter model. The ability to augment these various two-dimensional lattices with disorder or other forms of parameter variation promises to allow for the exploration of a broad range of lattice physics. We additionally describe the experimental progress towards creating Bose-Einstein condensates of potassium-39 atoms, the control of atomic interactions by a Feshbach resonance, and the implementation of two-dimensional momentum state synthetic lattices.

[1]This study is funded by the National Science Foundation under Grant No. 1707731 and by the Air Force Office of Scientific Research under Grant No. FA9550-18-1-0082.

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Date submitted: 31 Jan 2020 Electronic form version 1.4