Physics Colloquium

Brandon Anderson

"Engineering Novel Many-Body States in Modulated Condensates"

Cold atom systems have emerged as a powerful tool for studying dynamical and non-equilibrium physics in many-body systems. This stems from their precision control and easily accessible timescales. In this talk I present my recent work studying modulated Bose-Einstein condensates (BEC) and the novel many-body physics which arises from them. I start by considering a BEC in a shaken one-dimensional lattice. This system was experimentally shown to drive a quantum phase transition. I will present results of my numerical simulations of this system, highlighting dynamics across the critical point. I will show that for a specific range of parameters a quantum phase transition to a finite momentum superfluid is obtained with Kibble-Zurek scaling. I will then consider a BEC in a two-dimensional lattice, with the further addition of modulated interactions. The two key discoveries of this work are: (1) Atom-atom interactions are coupled with the micromotion of atoms in the shaken lattice. (2) By time modulating these interactions using a Feschbach resonance, we can engineer a density-dependent synthetic gauge potential. This theory was demonstrated experimentally in collaboration with the lab of Cheng Chin.

Brandon Anderson *is a postdoctoral scholar at the University of Chicago working with Risi Kondor on applications of machine learning to physical systems. Before that he was a postdoc with Kathyrn Levin at the University of Chicago, and Charles Clark at the Joint Quantum Institute at the University of Maryland. He also received his PhD from the University of Maryland under Victor Galitski. His previous research was focused on the novel states of matter that can be engineered in both cold atoms and solid state contexts. He was especially interested in working with experimentalists realizing these states. His current research focus is on machine learning, including applications of neural networks applied to atomistic and material systems.*

Physics Faculty and Search Committee Candidate

Thursday, February 1st in LL 316 at 4:10
Refreshments available at 3:45