NWS16-2016-000028

Abstract for an Invited Paper
for the NWS16 Meeting of
the American Physical Society

Mimicking spin-orbit coupling in ultracold gases

LINDSAY LEBLANC, Univ of Alberta

Ultracold quantum gases offer wonderful opportunities for exploring the behaviour of many-body systems using precise control over the atoms temperature, interactions, potential energy landscapes, and internal quantum degrees of freedom. In quantum simulation experiments, we use ultracold atomic gases of neutral atoms to study analogies to other physical systems, often with condensed matter phenomena in mind. As one of the tools in our arsenal, we use laser light to mimic spin-orbit coupling and create a well-defined relationship between the particles internal (spin) and motional ("orbit) degrees of freedom. For a first set of experiments in our lab we propose to use spatially dependent spin-orbit coupling to mimic a spin-dependent magnetic field, and to study the formation of vortices in Bose-Einstein condensates exposed to this. To build on this, we will combine this with techniques that tune the interparticle interactions, where it is predicted that competition between magnetic-like and superfluid-like many-body order should exist.