DAMOP15-2015-000204
Abstract for an Invited Paper
for the DAMOP15 Meeting of
the American Physical Society

Strongly Interacting Fermi Gases: Non-Equilibrium Dynamics and Dimensional Crossover[1]

ARIEL SOMMER, University of Chicago

Strongly interacting atomic Fermi gases near Feshbach resonances give access to a rich variety of phenomena in many-fermion physics and superfluidity. This flexible and microscopically well-characterized system provides a pristine platform in which to benchmark many-body theories. I will describe three experiments on gases of fermionic ^{6}Li atoms. In the first experiment, we study spin transport in the return to equilibrium after a spin excitation. From the dynamics near equilibrium, we obtain spin transport coefficients over a range of temperatures and interaction strengths, and observe quantum-limited spin diffusion at unitarity. In separate experiments, we study the effect of dimensionality on the binding of pairs of fermions. We tune the system from three to two dimensions by adjusting the strength of a one-dimensional optical lattice, and measure the binding energy of fermion pairs using radio-frequency spectroscopy. In a third set of experiments, we study nonlinear excitations of a fermionic superfluid. Imprinting a phase jump on the superfluid order parameter causes a long-lived, localized density depletion that oscillates through the cloud. We measure the oscillation period and find that it corresponds to an emergent particle with an effective mass of up to several hundred times the bare mass. This excitation has been identified as a solitonic vortex that results from the decay of a planar soliton.

[1]This work was performed at the Massachusetts Institute of Technology under the supervision of Prof. Martin Zwierlein