Abstract for an Invited Paper
for the DAMOP07 Meeting of
The American Physical Society

**Experimental realization of BCS-BEC crossover physics with a Fermi gas of atoms**[1]

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In my talk I will present experiments performed with a strongly interacting Fermi gas of $^{40}$K atoms. These experiments, along with the work of groups studying the fermion $^{6}$Li, pioneered many new techniques for the study of ultracold Fermi gases and culminated in the observation of fermion pairing and superfluidity. As a first step in this work Feshbach resonances between $^{40}$K atoms were found and characterized. At these scattering resonances, we had the unique ability to arbitrarily tune the fermion-fermion interaction, and we discovered how to convert a large fraction of our fermionic atoms into bosonic molecules. By adiabatically converting a low entropy Fermi gas to such molecules, we created one of the first molecular Bose-Einstein condensates. Even more importantly I will describe how we were able to observe a phase transition near the peak of the Feshbach resonance through condensation of fermionic atom pairs. The pairs here have some properties of Cooper pairs and some properties of diatomic molecules. The physics is thus in the crossover between BCS superconductivity and Bose-Einstein condensation (BEC) of tightly bound pairs. Lastly, I will discuss an example of what we learned from subsequent studies of BCS-BEC crossover physics.

[1]This work was performed at the University of Colorado, Boulder under the direction of Dr. Deborah Jin.