Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Dynamics of a quantum quench in an ultracold atomic BCS superfluid[1] BOGDAN DAMSKI, CHIH-CHUN CHIEN , Los Alamos National Laboratory — We study dynamics of an ultracold atomic BCS superfluid driven toward the BCS superfluid-Fermi-liquid quantum critical point by a gradual decrease of the pairing interaction. We analyze how the BCS superfluid falls out of equilibrium and show that the nonequilibrium gap and Cooper pair size reflect critical properties of the transition. We observe three stages of evolution: adiabatic where the Cooper pair size is inversely proportional to the equilibrium gap, weakly nonequilibrium where it is inversely proportional to the nonequilibrium gap, and strongly nonequilibrium where it decouples from both equilibrium and nonequilibrium gap. Using the Kibble-Zurek formalism, we derive scaling laws relating the non-equilibrium gap and the Cooper pair size to the quench rate. These results agree with numerical simulations. Our work should stimulate future experimental characterization of nonequilibrium ultracold atomic BCS superfluids. This work in published by C.C. Chien and B. Damski in Phys. Rev. A 82, 063616 (2010).

[1]This work is supported by U.S. Department of Energy through the LANL/LDRD Program.

Bogdan Damski
Los Alamos National Laboratory

Date submitted: 08 Feb 2011 Electronic form version 1.4