Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Paired Fraction of Ultracold Atoms in the BEC-BCS Crossover[1]

YEAN-AN LIAO, WENHUI LI, T. PAPROTTA, A.S.C. RITTNER, R.G. HULET, Department of Physics and Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005 — We report quantitative measurements of the paired fraction of a two-spin mixture of ^{6}Li atoms as a function of interaction strength and temperature. The interaction strength is tuned from the molecular BEC regime to the BCS regime using a Feshbach resonance. The fraction of atoms that are paired is measured by photo-exciting the pairs to a spatially small vibrational level of an electronically excited state of the Li_2 diatomic molecule[2]. We find that a fraction of the gas is rapidly excited, while the remaining atoms undergo a relatively slow photoassociative process. The photoexcitation rate is a function of time, therefore, shows a kink, which we interpret as the depletion of pairs. The location of the kink is independent of the photo-excitation laser intensity, as long as it is fast compared to the pair reformation time. At sufficiently low temperature, we find the paired fraction varies from near unity at the BEC limit, to below our limits of detectability on the BCS side. At unitarity, we observe preformed pairs above T_c, a phenomenon shared with high-temperature superconductors.

[1]Supported by NSF, ONR, and The Welch and Keck Foundations.
[2]G. B. Partridge *et al.*, *Phys. Rev. Lett.* **95**, 020404 (2005).

Yean-an Liao
Rice University

Date submitted: 30 Nov 2009 Electronic form version 1.4