Abstract Submitted
for the DAMOP08 Meeting of
The American Physical Society

Determination of the Fermion Pair Size in a Strongly Interacting Superfluid[1] CHRISTIAN SCHUNCK, YONG-IL SHIN, ANDRE SCHIROTZEK, WOLFGANG KETTERLE, MIT — Fermionic superfluidity requires the formation of pairs. The pair size relative to the interparticle spacing has a strong impact on the properties of the superfluid. This can be explored in ultracold atomic gases where a resonantly interacting superfluid in the crossover from a Bardeen-Cooper-Schrieffer type superfluid of loosely bound and large Cooper pairs to Bose-Einstein condensates of tightly bound molecules has been realized. We probe the microscopic properties of the fermion pairs in the crossover regime with radio-frequency (rf) spectroscopy. Previous measurements of rf spectra were difficult to interpret due to strong final state interactions. Here we present, using a new superfluid spin mixture where such interactions have a negligible influence, fermion-pair dissociation spectra that reveal the underlying pairing correlations. This allows us to determine the fermion pair size in the resonantly interacting gas to be 1.4(2)/kF smaller than the interparticle spacing and the smallest pairs observed in fermionic superfluids (kF is the Fermi wave number). This finding highlights the importance of small fermion pairs for superfluidity at high critical temperatures.

[1]Supported by NSF, ONR, and funds from MURI and DARPA OLE (ARO Award W911NF-07-1-0493) programs

Christian Schunck
MIT

Date submitted: 02 Feb 2008 Electronic form version 1.4