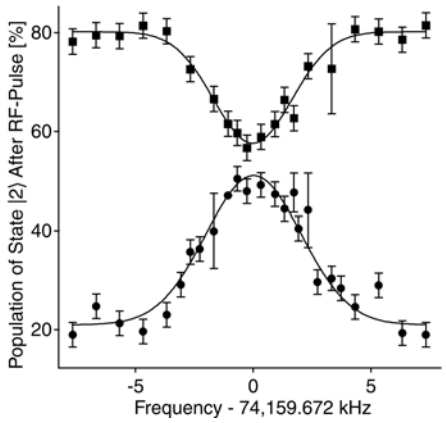
Spectroscopic insensitivity to cold collisions in a two-state mixture of fermions

We have experimentally addressed the relation between coherence and spectroscopic measurements in a binary mixture of ultracold fermions. We demonstrated that shifts of spectroscopic lines are absent even in a fully decohered binary mixture, in which the particles are distinguishable, and the many-body mean-field energy in the system has developed [1]. We theoretically showed that this is a direct consequence of the coherent nature of the RF excitation, and is not dependent on the coherence of the sample on which spectroscopy is performed. Our calculation intuitively explains both our results for fermions, and previous results for bosons obtained in Boulder [2].



Absence of mean-field shift of an RF transition in a binary Fermi system. The resonance curves were measured for fully decohered 80%/20% two-state mixtures of fermions. The measured frequency difference between the two lines is (34 ± 146) Hz, even though a simple mean-field model would predict a splitting of 20 kHz.

1. M.W. Zwierlein, Z. Hadzibabic, S. Gupta, and W. Ketterle, *Spectroscopic insensitivity to cold collisions in a two-state mixture of fermions*, Phys. Rev. Lett. **91**, 250404 (2003).
2. D.M. Harber, H.J. Lewandowski, J.M. McGuirk, and E.A. Cornell, in *Proceedings of the XVIII International Conference on Atomic Physics*, edited by H.R. Sadeghpour, E.J. Heller, and D.E. Pritchard (World Scientific, Cambridge, Massachusetts, 2003) p. 3.