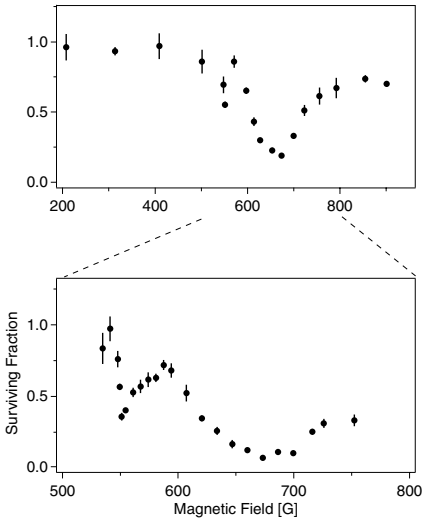
## Decay of an ultracold fermionic lithium gas near a Feshbach resonance

The interactions between atoms can be strongly modified by tuning magnetic fields to Feshbach resonances where a molecular state has the same energy as the colliding atoms. For degenerate Fermi gases, such control over the interaction strength is crucial in the search for a superfluid phase transition. Otherwise, the phase transition temperatures are too low to be experimentally accessible. Near Feshbach resonances, the enhancement of the scattering length is usually accompanied by enhanced inelastic collisions, which lead to rapid trap loss. We have performed the first study of inelastic collisions in a fermionic system near a Feshbach resonance. We have observed resonant magnetic field dependent inelastic decay of an ultracold, optically trapped spin mixture of $^6$Li [1].

The spin mixture of the two lowest hyperfine states showed two decay resonances at 550 G and 680 G. The feature near 680 G may be related to the long-predicted Feshbach resonance around 800 G. The resonance at 550G was unexpected, but new theoretical calculations have now identified it as an additional Feshbach resonance [2], which was not found in previous calculations. Even on resonance, the observed decay happened on a time scale longer than the trap oscillation time, the time for elastic collisions, and the expected sub-millisecond time needed for the formation of Cooper pairs.




Magnetic field dependence of inelastic decay of lithium in a 50%-50% mixture of the lowest two hyperfine states. The fraction of the atoms remaining after a 500 ms magnetic field pulse is shown (upper graph). The two resonances are shown in more detail for 2 s magnetic field pulses (lower graph).


1. K. Dieckmann, C.A. Stan, S. Gupta, Z. Hadzibabic, C. Schunck, and W. Ketterle, *Decay of ultracold Fermionic lithium gas near a Feshbach resonance*, Phys. Rev. Lett. **89**, 203201 (2002).
2. K.M. O'Hara, S.L. Hemmer, S.R. Granade, M.E. Gehm, J.E. Thomas, V.Venturi, E. Tiesinga, and C.J. Williams, *Measurement of the Zero Crossing in a Feshbach Resonance of Fermionic $^6$Li*, Phys. Rev. A **66**, 041401(R) (2002).