Chez Pierre

Presents ...

Monday, April 6, 2009
12:00pm
MIT Room 4-331

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"Swimming in the Fermi sea: Observation of Fermi Polarons in a tunable Fermi liquid of ultracold atoms"

We have observed Fermi polarons in a highly imbalanced mixture of fermionic atoms using tomographic RF spectroscopy. Feshbach resonances allow to freely tune the interactions between the two spin states involved. A single spin down atom immersed in a Fermi sea of spin up atoms can do one of two things: For strong attraction, it can form a molecule with exactly one spin up partner, but for weaker interaction it will spread its attraction and surround itself with a collection of majority atoms. This spin down atom "dressed" with a spin up cloud constitutes the Fermi polaron. We have observed a striking spectroscopic signature of this quasi-particle for various interaction strengths, which allows us to directly measure the polaron energy and infer the quasi-particle residue Z. The polarons are weakly interacting, and can thus be identified with the quasi-particles of Landau's Fermi liquid theory. At a critical interaction strength, we observe a transition from polarons to molecules. At this point the Fermi liquid of polarons undergoes a phase transition into a superfluid Bose liquid.