

MAR06-2005-001428

Abstract for an Invited Paper
for the MAR06 Meeting of
the American Physical Society

Superfluid stability in polarized Fermi atomic gases

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For a two-species atomic Fermi gas with equal populations, it is now widely accepted that a smooth BCS-BEC cross-over occurs when the Feshbach resonance is crossed. However, the situation is very different if the populations of the two species are different. In particular, the uniform state is stable only either (a) for sufficiently negative detuning, where the system is a gapless mixture of Bose condensed pairs and unpaired normal Fermions, or (b) for sufficiently positive detuning, where Fermions are unpaired and the system is in the normal state. No uniform state is stable in between. Phase transition(s) must therefore occur when the resonance is crossed. We discuss the theoretical phase diagram of this system in this talk.