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The Low-Temperature Phases of Polarized Fermionic Superfluids

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A number of recent experiments have achieved paired superfluidity of trapped fermionic atomic gases. Such pairing, occurring between two atomic hyperfine-state species (forming a pseudo-spin 1/2 system), is possible due to the strong attractive interactions provided by a magnetic field tuned Feshbach resonance (FR). At equal populations, the superfluidity of resonantly interacting Fermi gases undergoes the well-studied crossover between Bardeen-Cooper-Schrieffer (BCS) pairing and Bose-Einstein condensation (BEC) as a function of FR detuning (or interaction strength). I will discuss recent work [1] aimed at understanding the case of *unequal* populations (i.e., imposed spin polarization), an easily controllable experimental knob that is predicted to interrupt the continuous equal-population BCS-BEC crossover, yielding a variety of distinct phenomena including regions of singlet paired superfluid, unpaired polarized normal Fermi liquid, polarized Fulde-Ferrell-Larkin-Ovchinnikov superfluid, polarized magnetic superfluid, and phase-separated mixtures of these uniform states. I will describe the low-temperature phase diagram of such polarized fermionic superfluids, focusing particularly on experimental signatures of the various phases in the inhomogeneous environment of the trap. [1] D.E. Sheehy and L. Radzihovsky, Phys. Rev. Lett. **96**, 060401 (2006); cond-mat/0607803 (Annals of Physics, in press).