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Phase diagram of a two-component Fermi gas with resonant interactions YONG-IL SHIN, CHRISTIAN H. SCHUNCK, ANDRE SCHIROTZEK, WOLFGANG KETTERLE, MIT — The pairing of fermions is at the heart of superconductivity and superfluidity. The stability of these pairs determines the robustness of the superfluid state. In this talk, the phase diagram of a two-component Fermi gas at unitarity, i.e. when the fermions interact resonantly, will be presented. The phase diagram has experimentally obtained by mapping out the superfluid phases versus temperature and density imbalance. At low temperature, the superfluid-to-phase transition occurs with a jump in the spin polarization, the signature of a first-order phase transition. At high temperature, the phase transition is smooth and therefore of second-order. We have identified a tricritical point where the nature of the phase transition changes from first-order to second-order. In our experiment, absolute temperatures were obtained using in situ thermometry applied to the non-interacting Fermi gas in the outer part of the trapped samples. Furthermore, the quantitative analysis of the density profiles of the sample at our lowest temperature shows that at zero temperature, there is a quantum phase transition from a fully-paired superfluid to a partially-polarized normal gas. (Y. Shin et al., arXiv:0709.3027)

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