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Theory of BCS-BEC Crossover in Ultracold Fermi Gases: Insights into Thermodynamical and Spectroscopic Experiments

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In this talk we summarize our theoretical understanding of the atomic Fermi superfluids with an emphasis on understanding current experiments. We compare and contrast different theoretical approaches for dealing with finite temperature, and discuss their respective implications for these trapped gases. Armed with a basic picture of the thermodynamics we turn to a variety of different measurements based on radio frequency spectroscopy, including both momentum integrated and momentum resolved experiments. As recently reviewed in arXiv 0810.1940 and 0810.1938, we show how a broad range of experimental phenomena can be accommodated within our natural extension of the BCS-Leggett ground state to finite temperature, and briefly touch on the applicability of BCS-BEC crossover theory to the high temperature superconductors. Co-authors: Qijin Chen, Yan He and Chih-Chun Chien