Ultracold Fermi Gases: Providing Insights into Condensed- and Quark-Gluon Matter

Our understanding of the ultracold superfluid Fermi gases has undergone rapid advancement from the original discoveries in late 2003. This talk will review the ground breaking cold gas experiments emphasizing their relation to condensed matter counterpart tools including angle resolved photoemission, neutron scattering and transport analogues. We introduce the generalization of BCS theory known as BCS-BEC (Bose Einstein condensation) crossover and its possible connections to quark-gluon plasmas and high Tc superconductors. This unification of rather disparate fields leads to a "unifying controversy" associated with transport properties of BCS-BEC superfluids. In this context we discuss the shear viscosity showing how recent Fermi gas experiments inform our understanding of perfect fluidity in quark gluon plasmas and "bad metallicity" in the cuprate superconductors.