Specific heat in quantum critical systems:

Multi-flavor criticality and Kramers doublets

Andreas Rydh
Department of Physics
Stockholm University

Abstract

Electronic correlations in quantum-critical metals are reflected in an enhancement of the quasiparticle mass on the Fermi surface. Specific heat is a powerful probe to investigate the corresponding electronic density of states and scaling of quantum critical fluctuations as a function of temperature, magnetic field, and sample orientation. In this talk, I will discuss indications of quantum criticality as seen from specific heat, with focus on the heavy-fermion superconductor $CeCoIn_5$, where the normal state can be readily accessed. At low temperatures, a measurement extension to include the frequency domain, so called thermal impedance spectroscopy, allows concurrent access to the nuclear spin-lattice relaxation rate, an additional independent probe of the electronic density of states. A comparison of the two probes indicates the presence of multiple flavors of critical fluctuations [1]. Their electronic nature is evidenced by their suppression in the superconducting state. The role of the splitting of the Ce^{3+} Kramers doublet for the observed heat capacity will be discussed.

[1] A. Khansili, A. Bangura, D. R. McDonald, B. J. Ramshaw, A. Rydh, and A. Shekhter, arXiv:2311.11914.