量子物质科学协同创新中心&物理系

Collaborative Innovation Center of Quantum Matter & Department of Physics

Quantum Critical Fluctuations Leading to Strange Metals in 2D Metallic Anti-Ferromagnets, Ferromagnets and in the Cuprates

Abstract: Models for metallic anti-ferromagnets map to the dissipative XY model as do XY ferromagnets, the superconductor-insulator transition, and the model for loop-current order in Cuprates. The spectral function of the quantum-critical fluctuations for this model in 2D for a range of parameters is determined by topological defects - instantons and 2D vortices; it is a separable function of space and time, with a $1/\tau$ dependence at criticality. The marginal fermi-liquid properties for the fermions follow from coupling to such fluctuations.

These fluctuations are directly measured by inelastic neutron scattering in the quantum-critical region of the new Fe- based compounds, in a 2D ferromagnet and in heavy-Fermions, and deduced in cuprates through analysis of ARPES. ARPES also reveals the coupling function of the fermions to the fluctuations so as to give nearly angle-independent normal self-energy but d-wave pairing energy.

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