



Walther-Meißner-Seminar

Walther-Meißner-Institute, Seminar Room 143

Date: Monday, 18 September 2023, 15:15 h

Speaker: Dr. Makariy A. Tanatar

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Title: Anisotropic Melting of Frustrated Ising Antiferromagnets

Abstract:

Suppression of the long-range magnetic order by a nonthermal tuning parameter, like pressure, composition, stress or magnetic field frequently drives materials to a quantum critical point (QCP). Anomalous electronic properties observed in the vicinity of a QCP reveal strong deviations from the Fermi liquid theory of Landau and include a diverging effective mass, anomalous power-law temperature-dependent resistivity, and logarithmically diverging specific heat. In this talk, I will discuss the non-Fermi liquid phenomena in the heavy-fermion superconductor CeCoIn_5 tuned by magnetic field to its quantum critical point. The material reveals a striking anisotropy of the resistivity at the QCP. To facilitate understanding of this anisotropy, ordering in classical helimagnets was studied both experimentally in helimagnetic EuCo_2P_2 and theoretically in frustrated Ising spin models in two spatial dimensions [1]. A strong anisotropy of the precursor phenomena is found above the long-range ordering temperature T_N in EuCo_2P_2 . The anisotropy suggests that ordering within ferromagnetic planes takes place at notably higher temperatures than ordering along the c -axis. Theoretical calculations confirm that the melting of the magnetic long-range order into an isotropic gaslike paramagnet proceeds via an intermediate stage where the classical spins remain anisotropically correlated. This correlated paramagnet exists in a temperature range $T_N < T < T^*$, whose width increases as magnetic frustrations grow.

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References

[1] M. Butcher, M.A.Tanatar, and A.H.Nevidomskyy, Phys. Rev. Lett. 130, 166701 (2023).