Physics Seminar

"Intertwined Orders in a Heavy-fermion metal"

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The role of magnetic fluctuations is a major interest in recent studies on unconventional superconductivity. The heavy-fermion metal $CeCoIn_5$ provides an interesting platform to study the relationship between magnetism and superconductivity. In the low-temperature and high-field corner of its *H-T* phase diagram, $CeCoIn_5$ shows a spin-density-wave (SDW) magnetic order coexisting with the superconductivity. This antiferromagnetic order has single domain and switches its orientation very sharply depending on the direction of the magnetic field. This hypersensitivity of the magnetic domain induces a discontinuous change of the thermal conductivity when the magnetic field is rotated in the basal plane of the tetragonal crystal. This measurement reveals the presence of a *p*-wave Cooper-pair-density-wave (PDW) order that is intimately intertwined with the superconducting *d*-wave and magnetic SDW orders. The concept of intertwined orders is a new framework to understand high-Tc and iron-based superconductors. $CeCoIn_5$ provides an important example of intertwined orders and establish its superconducting state as potentially a new state of matter.

[1] D. Y. Kim, S.-z. Lin, F. Weickert, M. Kenzelmann, E. D. Bauer, F. Ronning, J. D. Thompson, and R. Movshovich, *Physical Review X* **6**, 041059 (2016).

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