SFB/TRR 21 - Seminar

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Heavy Fermions in Flatland

When interacting electrons are confined to low-dimensions, the electron-electron correlation effect is enhanced dramatically, which often drives the system into exhibiting behaviours that are otherwise highly improbable. Superconductivity with the strongest electron correlations is achieved in heavy-fermion compounds, which contain a dense lattice of localized magnetic moments interacting with a sea of conduction electrons to form a three-dimensional (3D) Kondo lattice. It had remained an unanswered question whether superconductivity would persist upon effectively reducing the dimensionality of these materials from three to two. We report on the observation of superconductivity in such an ultimately strongly-correlated system of heavy electrons confined within a 2D square-lattice of Ce-atoms (2D Kondo lattice), which was realized by fabricating epitaxial superlattices [1] built of alternating layers of heavy-fermion CeCoIn5 and conventional metal YbCoIn5 [2]. The field-temperature phase diagram of the superlattices exhibits highly unusual behaviors, including a striking enhancement of the upper critical field relative to the transition temperature [2,3]. Possible origins of this enhancement will be discussed.

[1] H. Shishido et al., Science 327, 980-983 (2010) [2] Y. Mizukami et al., Nature Physics 7, 849-853 (2011) [3] S. K. Goh et al., arXiv:1207.4889 (2012)

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