



Colloquium

Quantum phases and fluctuations driven by strong correlations

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If two particles are “strongly correlated”, they are not independent of each other and any theoretical description has to take their interaction energy into account. For many-particle systems such as electrons in a metal this requires advanced many-body approaches. Today, many materials classes are known to host strongly correlated electrons, which manifests in a wealth of exotic – and frequently useful – properties, ranging from high-temperature superconductivity to colossal magnetoresistance. In this talk, I will discuss a materials class where the interaction strength is governed by the Kondo interaction between localized and itinerant electrons, making it highly tuneable by external parameters such as pressure or magnetic field. This allows to access various quantum phases, and transitions between them, with a single material, thereby enabling direct comparison with theory and thus advancing the understanding. Highlights of our recent research include the observation of singular charge fluctuations at a magnetic quantum critical point [1], a sequential electron localization transition in a spin-orbital coupled system [2], and the discovery of a Kondo-driven Weyl semimetal phase [3]. [1] L. Prochaska, X. Li, D. C. MacFarland, A. M. Andrews, M. Bonta, E. F. Bianco, S. Yazdi, W. Schrenk, H. Detz, A. Limbeck, Q. Si, E. Ringe, G. Strasser, J. Kono, and S. Paschen, Singular charge fluctuations at a magnetic quantum critical point, arXiv:808.02296. [2] V. Martelli, A. Cai, E. M. Nica, M. Taupin, A. Prokofiev, C. -C. Liu, H. -H. Lai, R. Yu, R. Kuchler, A. M. Strydom, D. Geiger, J. Haenel, J. Larrea, Q. Si, and S. Paschen, Sequential localization and strange-metal behavior of a complex electron fluid, arXiv:1709.09376. [3] S. Dzsaber, X. Yan, G. Eguchi, A. Prokofiev, T. Shiroka, P. Blaha, O. Rubel, S. E. Grefe, H.-H. Lai, Q. Si, and S. Paschen, Giant spontaneous Hall effect in a nonmagnetic Weyl-Kondo semimetal, arXiv:1811.02819.

Monday, March 25, 2019 04:00pm - 05:00pm

Raiffeisen Lecture Hall, Central Building



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