Impurity moments in d-wave superconductors

Matthias Vojta

Theoretische Physik III, Universität Augsburg, 86135 Ausgburg, Germany
matthias.vojta@physik.uni-augsburg.de

We discuss the physics of impurity moments in cuprate d-wave superconductors. Such moments can either arise from magnetic impurities (e.g. Ni), or they can be induced by doping non-magnetic impurities like Zn. In an effective low-energy description, the moments are coupled to the fermions of the host d-wave superconductor as well as to collective spin fluctuations.

We describe the process of the moment formation in the vicinity of non-magnetic impurities, the Kondo screening effects, and their suppression by host spin fluctuations. The relevant pseudogap Kondo model shows a boundary quantum phase transition between a free-moment phase and a Kondo-screened phase, and we argue that this transition has possibly been observed in recent NMR experiments. Near the quantum phase transition, the impurity properties become universal, and dynamic quantities show scaling behavior. The Kondo scattering leads to a characteristic peak at small, but finite energy in the local density of states which is related to recent STM measurements on Zn-doped cuprates.