SFB/TRR 21 - Seminar
26. Januar 2010, Stuttgart

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Quantum criticality and dynamical scaling in $YbRh_2Si_2$

Quantum criticality and dynamical scaling in $YbRh_2Si_2$ The heavy-fermion compound $YbRh_2Si_2$ exhibits antiferromagnetic ordering at 70 mK. Suppressing this transition to zero temperature by a tiny magnetic field leads to a quantum critical point. Conventionally, a quantum critical point is described by the quantum generalization of finite-temperature phase transitions. In this talk I present high-precision Hall effect measurements which are at variance with the predictions for both the static and dynamic behavior of the standard theory. On the one hand, the data suggest a reconstruction of the Fermi surface and on the other hand, they allow to exclude the dynamical scaling predicted by the conventional theory. The results rather suggest a breakdown of the Kondo effect as the dominant mechanism.

In addition, I show recent results revealing the global phase diagram of $YbRh_2Si_2$ under positive and negative chemical pressure as realized by Co and Ir substitution on the Rh side. Surprisingly, this leads to a detachment of the antiferromagnetic quantum critical point from the Fermi surface reconstruction. In particular, negative pressure induces a separation of the two with an intermediate spin-liquid type ground state emerging in an extended field range. These results indicate a new quantum phase arising from the interaction of the Kondo breakdown and the AF QCP.

26. Januar 2010, 13:00 Uhr

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