Session 23bC

The heavy fermion quantum critical point. 23bC1

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We discuss non-Fermi liquid and quantum critical behavior in heavy fermion materials, focussing on the mechanism by which the electron mass appears to diverge at the quantum critical point. We ask whether the basic mechanism for the transformation involves electron diffraction off a quantum critical spin density wave, or whether a break-down in the composite nature of the heavy electron takes place at the quantum critical point. We show that the Hall constant changes continously in the first scenario, but may "jump" discontinuously at a quantum critical point where the composite character of the electron quasiparticles changes.

Breakdown of the Fermi surface at the quantum critical point in $YbRh_2Si_2$ 23bC2

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In $YbRh_2Si_2$ pronounced Non-Fermi liquid (NFL) effects are observed in thermodynamic, magnetic and transport properties above a weak antiferromagnetic (AF) phase transition at $T_N = 70$ mK. The AF order is suppressed to $T_N \rightarrow 0$ either by i) the application of small critical magnetic fields B_{c0} or ii) a slight expansion of the crystal lattice by substituting 5% of the Si atoms by Ge in $YbRh_2(Si_{1-x}Ge_x)_2$. In both cases the NFL behavior extends to lowest T. For $B > B_{c0}$ ($B_{c0} = 0$ for $x = 0.05$) we observe a weakly polarized Landau FL at lowest T which fulfills the Kadowaki-Woods relation $A/\gamma_0^2 = const$ between the coefficients A of the resistivity and γ_0 of the specific heat. The $1/(B - B_{c0})$ divergence of $A(B)$ indicates that the heavy quasiparticles diverge at the quantum critical point.

23bC3 Inhomogeneous Magnetism and Hidden Order in URu_2Si_2

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Recent microscopic studies on URu_2Si_2 have proven the presence of some nonmagnetic “hidden order” to be responsible for sharp bulk anomalies observed at 17.5 K $(\equiv T_\mathrm{o})$ in this system, showing the puzzling tiny moments detected by neutron scattering to be ascribed to unusual coexistence (~ 1 %) of a normal moment $(\sim 0.25 \mu_\mathrm{B}/\mathrm{U})$ antiferromagnetic phase. We present the neutron scattering and μSR measurements performed under hydrostatic pressure and uniaxial stress, and discuss the relationship between these two different ordered phases and possible interpretation of the hidden order parameter.