NON-FERMI LIQUID BEHAVIOR DOWN TO 0.05 K AND IN FIELDS UP TO 30 T

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Introduction

Specific heat and resistivity measurements on f-electron compounds down to 0.05 K and up to 30 T are used to probe for low temperature non-Fermi liquid behavior, using disorder due to doping as an additional measurement parameter.

Experimental

Using SCM-1 at NHMFL, Tallahassee, measurements were made on the resistivity, ρ , and the specific heat, C, down to 0.05 K in fields $\leq$18 T on $UCu_{5-x}Ni_x$ alloys near the quantum critical point (QCP), where $T_{Neel} \rightarrow 0$ at $x \approx 1.0$. Site disorder was guaranteed due to the fact that Ni is *smaller* than Cu and is therefore – at the x=1 composition – approximately equally distributed on the four smaller Cu sublattice sites known as 'Be II' sites from nomenclature arising from the structure prototype compound $AuBe_5$. Measurements of the specific heat of $Cr_{0.965}V_{0.035}$ and $Cr_{0.94}V_{0.06}$ (i.e. Cr doped *at* as well as beyond the QCP) were also performed in SCM-1 to check for non-Fermi liquid behavior. Additionally, specific heat measurements in the 31 T magnet in cell 5, NHMFL, Tallahassee, were made down to 0.4 K around the reported metamagnetic transition of 25 T in an aligned collage of single crystals of $CeRh_2Si_2$, with **B** applied in the c-axis direction.

Results and Discussion

It was discovered that the magnetic transition in $CeRh_2Si_2$ as seen in the specific heat – contrary to published magnetization results – is not suppressed to 0 temperature by fields up to 30 T. The specific heat of the doped Cr samples showed C/T $\approx$ constant down to about 0.1 K, followed by an as yet unexplained transition (sharp decrease in C/T) below this temperature. Thus, non-Fermi liquid behavior was not observed in the specific heat of Cr doped to its QCP.

The low temperature resistivity of $UCu_{5-x}Ni_x$ displays a quite large (~ 1000 $\mu\Omega$ cm) residual resistivity as well as a logT temperature dependence which appears to stem from a lattice Kondo effect associated primarily with the disorder rather than an effect associated with the quantum critical point [1], see Fig. 1. The specific heat display QCP behavior, C/T ~ logT, only *at* x_{QCP}=1.0, with power law behavior already clearly present by x=1.05 [2].

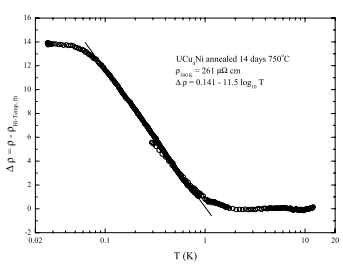

Fig. 1. $\Delta\rho$ vs. logT for $UCu_{5-x}Ni_x$, x=1.0, showing an approximate straight line behavior from 0.09 to 1 K.

References

[1] Stewart, G.R, *et al*., submitted to Annals of Physics.
[2] Mixson, D.J., *et al*., submitted to Physical Review B.