(28d5)

Non-Fermi Liquid Behavior in $Pr_xLa_{1-x}Pb_3$ with $x \leq 0.05$

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We have studied the low temperature properties of $Pr_xLa_{1-x}Pb_3$ with the ground state of a non-Kramers Γ_3 doublet for the Pr concentration for $0 \leq x \leq 1$. Three different states is propbably realized as a function of Pr concentration x at low temperatures. The quadrupolar ordeing, which occurs at T_Q=0.4 K in $PrPb_3$, appears for $x \geq 0.98$. For a wide range of Pr concentration for $0.1 \leq x \leq 0.95$, the specific heat shows a T-linear variation below 0.5 K with a large coefficient, which can be reproduced by the model for amorphous materials with a random configuration of two level system[1]. The glass-like state may be realized. In a very dilute region of the quadrupolar moments, $x \leq 0.05$, a non-Fermi liquid (NFL) behavior is observed[2]. The specific heat C/T increases monotonically below T =1.5 K as shown in the figure and the electrical resistivity $\rho(T)$ shows a marked decrease deviating from a Fermi-liquid behavior $\rho(T) \propto T^2$. C/T is scaled with a characteristic temperature T^* defined at each concentration x as shown in the inset of the figure, where T^* changes exponentially with the volume. This suggests that the concentration dependence of T^* can be explained by the change of hybridization width due to the volume change. NFL behavior for $x \leq 0.05$ is understood as a single-ion effect, and may be caused by the Kondo effect arising from the correlation between the dilute Γ_3 moments and the conduction electrons. To confirm the scenario, we measures the magnetic field dependence of the specific heat for $Pr_xLa_{1-x}Pb_3$. The results for x=0.05 will be given in the presentation.

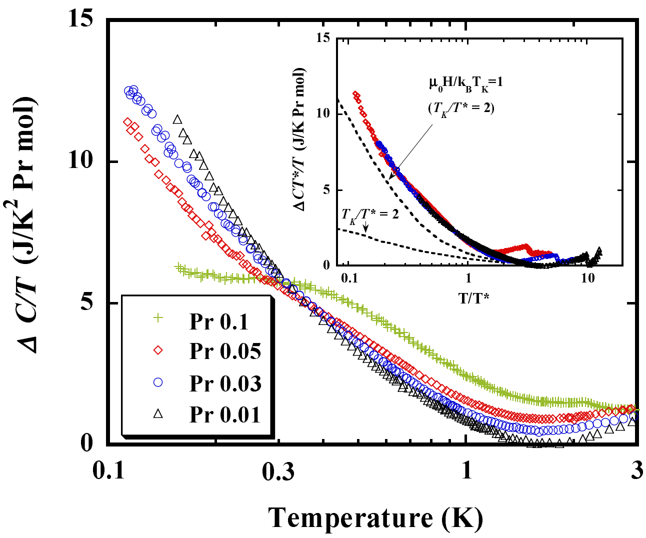

Figure 1: The temperature dependence of C/T for x=0.1, 0.05, 0.03 and 0.01, where C/T is normalized by the Pr concentrations and the back ground contribution estimated from $LaPb_3$ is subtracted. Inset: $\Delta CT^*/T$ versus $\log(T/T^*)$. T^* is taken to be 1 K for x=0.05, 0.65 K for x=0.03 and 0.40 K for x=0.01.

[1] T. Kawae et al., Phys. Rev. B**65** (2002) 012409.

[2] T. Kawae et al., J. Phys. Soc. Jpn. **72** (2003) 2141.