High Pressure Low Temperature Magnetoresistance and Hall Effect of $Pr_{2-x}Ce_xCuO_{4-\delta}$ for Doping Close to x=0.17

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Introduction

The existence of a quantum critical point (QCP) in-side the superconducting (SC) dome in electron-doped high *Tc* cuprates is still highly debated. Despite the recent inelastic neutron scattering study [1] of Greven's group arguing for a QCP outside the SC feature for NCCO, new Hall Effect data for PCCO [2] shows no signature of a quantum phase transition (QPT) close to x~0.13 (outside SC region), but rather for x~0.17 [3]. The QCP in discussion is for an antiferromagnetic (AFM) to paramagnetic metal (PM) quantum phase transition. The magnetoresistance exhibits an unconventional behavior near the same critical doping of Ce~0.17 [4]. Infrared conductivity measurements [5] also tracked the quantum critical behavior for this Ce concentration. In the present proposal we intend to extend the previous work by a high pressure study to a better understanding of the QPT.In principle, pressure is a much better tuning parameter than doping. This has been shown in pressure studies of an AFM to PM QPT in heavy fermion systems, e.g. $CeCoIn_5$. The few studies done in electron-doped cuprate [6-8], until now up to just 2.5 GPa, show modest changes in physical properties, if any. There are no pressure Hall measurements available to date, to our best knowledge, on *n*-doped cuprate. Our belief is that greater pressure is needed in order to change the transfer integrals or the Coulomb correlations to possibly drive the system through the QPT.

Experimental

We plan to study also the temperature dependence of the Hall Effect and the field dependence of resistivity. We will use our samples (crystals) that have already been synthesized/characterized/and measured under normal pressure. These measurements will try to answer some important questions related to the normal state transport: the nature of the low temperature resistivity upturn, the negative magnetoresistance and the T^2 dependence of resistivity at higher temperature. All these measurements can be done using the high pressure setup at the 20 T superconducting magnet (SCM). Hall Effect will be measured by van der Pauw technique.

Results and Discussion

Because of difficulties related to the electrical contacts to the sample, the experiment will be performed after the contact resistance has been reduced.

Conclusions

None

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