ANGULAR MAGNETORESISTANCE OSCILLATIONS IN $Tl_2Ba_2CuO_6$ (T_c ~ 45K)

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Introduction

In October 2003, we reported the first observation of polar angular magnetoresistance oscillations (AMRO) in a high-T_c cuprate through measurements of the angular dependence of the *c*-axis magnetoresistance in overdoped $Tl_2Ba_2CuO_6$ (Tl2201) single crystals (T_c ~ 15K) [Figure 1a]. This work also provided the first unquestionable proof that cuprates at this particular doping level, *c*-axis conductivity is indeed coherent at low temperature and provided the only full three-dimensional representation of a high-T_c cuprate Fermi surface to date [1]. The next stage of this program was to investigate how this AMRO signal evolved as we decreased doping and moved closer to optimal doping (where T_c = 90K). Our first measurements on Tl2201 single crystals with a higher T_c (= 45K) were carried out in December 2003.

Results and Discussion

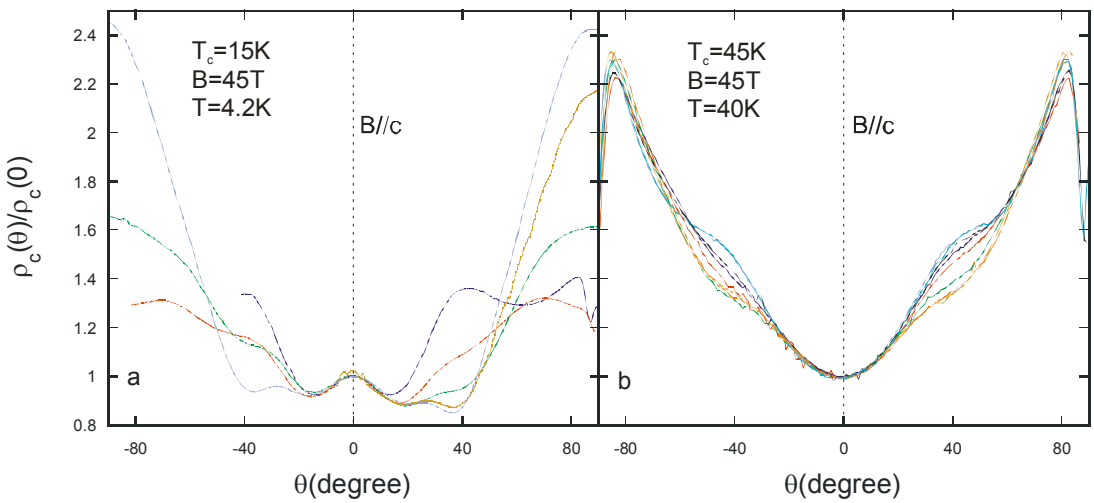

Figure 1a) Polar AMRO sweeps in an overdoped Tl2201 single crystal (T_c ~ 15K) at T = 4.2K and B = 45T. The different azimuthal orientations of each polar sweep are related to the Cu-O-Cu bond direction. 1b) Polar AMRO sweeps in a lower doped Tl2201 single crystal (T_c ~ 45K) taken at 40K and B = 45T.

Measurements on Tl2201 crystals with higher T_c values revealed very different AMRO patterns as shown in Figure 1b). One of the most striking differences is the absence of a central peak around $B//c$. The origin of this central peak in the lower T_c crystals is related to coherent hopping between adjacent CuO_2 planes. Its absence in the 45K crystals suggests we may be approaching the coherent/incoherent boundary for *c*-axis transport even at this relatively high doping level. Other aspects of *c*-axis coherence however are still evident in the data, e.g. the AMRO peak at intermediate angles that contains strong azimuthal dependence. Hence, signals of coherence and incoherence are appearing to coexist. To our knowledge, this has never previously been observed in a quasi-2D metal and it is our belief that a more careful study of the evolution of the AMRO pattern with field and temperature will provide unprecedented insight into the coherent-incoherent crossover in layered metals. How this correlates with the evolution of the in-plane quasiparticle states with doping and temperature will be a fascinating area of future study.

Acknowledgements

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References

[1] Hussey, N.E., *et al*., Nature, **425**, 814 (2003).