DOPING DEPENDENCE OF THE HIGH-FIELD NERNST EFFECT IN $La_{2-x}Sr_xCuO_4$

Yayu Wang; N. P. Ong (Princeton U., Physics); Y. Ando (CRIEPI, Tokyo) and S. Uchida (U. of Tokyo)

Introduction

The vortex Nernst effect has shed important light on the nature of the pseudogap state and the anomalous high-field phase diagram of the cuprates [1,2]. However, some key issues remain unsettled. A detailed investigation of the high-field Nernst signals across the whole phase diagram may reveal new features to enhance our understanding of the Nernst effect, and the underlying physics of high T_c superconductivity.

Experimental

The vortex Nernst effect measures the transverse electrical field generated by the flow of superconducting vortices in a longitudinal temperature gradient. The experimental details have been described in ref. 2. The high-field measurements were carried out in the 33-tesla DC magnet and the 45-tesla hybrid magnet in NHMFL.

Results and Discussion

Fig. 1 displays the Nernst signal *vs.* magnetic field curves taken at selected temperatures on $La_{2-x}Sr_xCuO_4$ over a wide range of hole densities ($0.03 < x < 0.26$). The prominent feature is that the magnitude of the Nernst signal reaches a maximum at $x = 0.12$, and drops rapidly on both sides. For $x < 0.12$, the decrease of $\boldsymbol{e_y}$ is caused by the smaller superfluid density as the Mott insulator is approached. For $x > 0.12$, the small $\boldsymbol{e_y}$ value is an indication of vanishing gap amplitude.

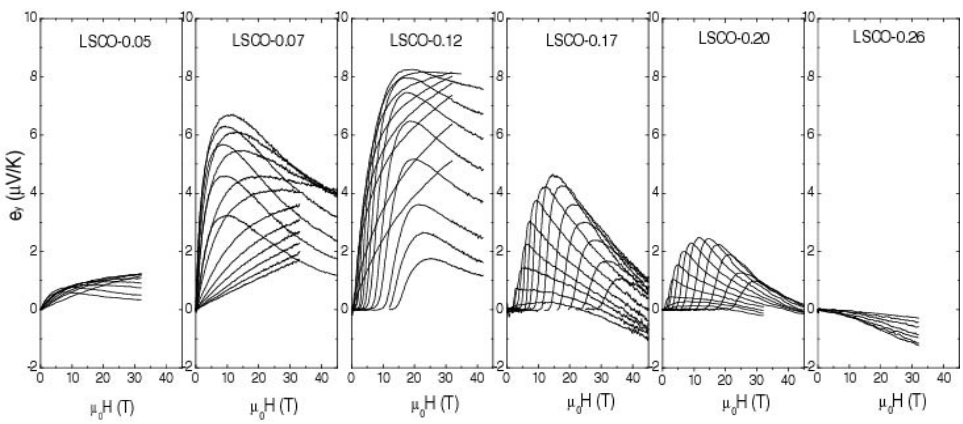

Figure 1: The Nernst signal ($\boldsymbol{e_y}$) *vs.* magnetic field (H) traces of the LSCO cuprates.

Conclusions

The doping dependence of the high-field Nernst effect in cuprates suggested that the superconducting phase transition is induced by the loss of phase coherence in the underdoped region and the vanishing of gap amplitude in the overdoped region.

Acknowledgements

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References

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[2] Wang, Yayu, *et al.*, Science **299**, 86-89 (2003).