

The American Physical Society

20-26 March 1999, Atlanta, GA

WC25 DCMP: HTSC Misc: Experimental

Field Dependence of Diamagnetic Shielding Fraction with Carrier Concentration in HTSCs

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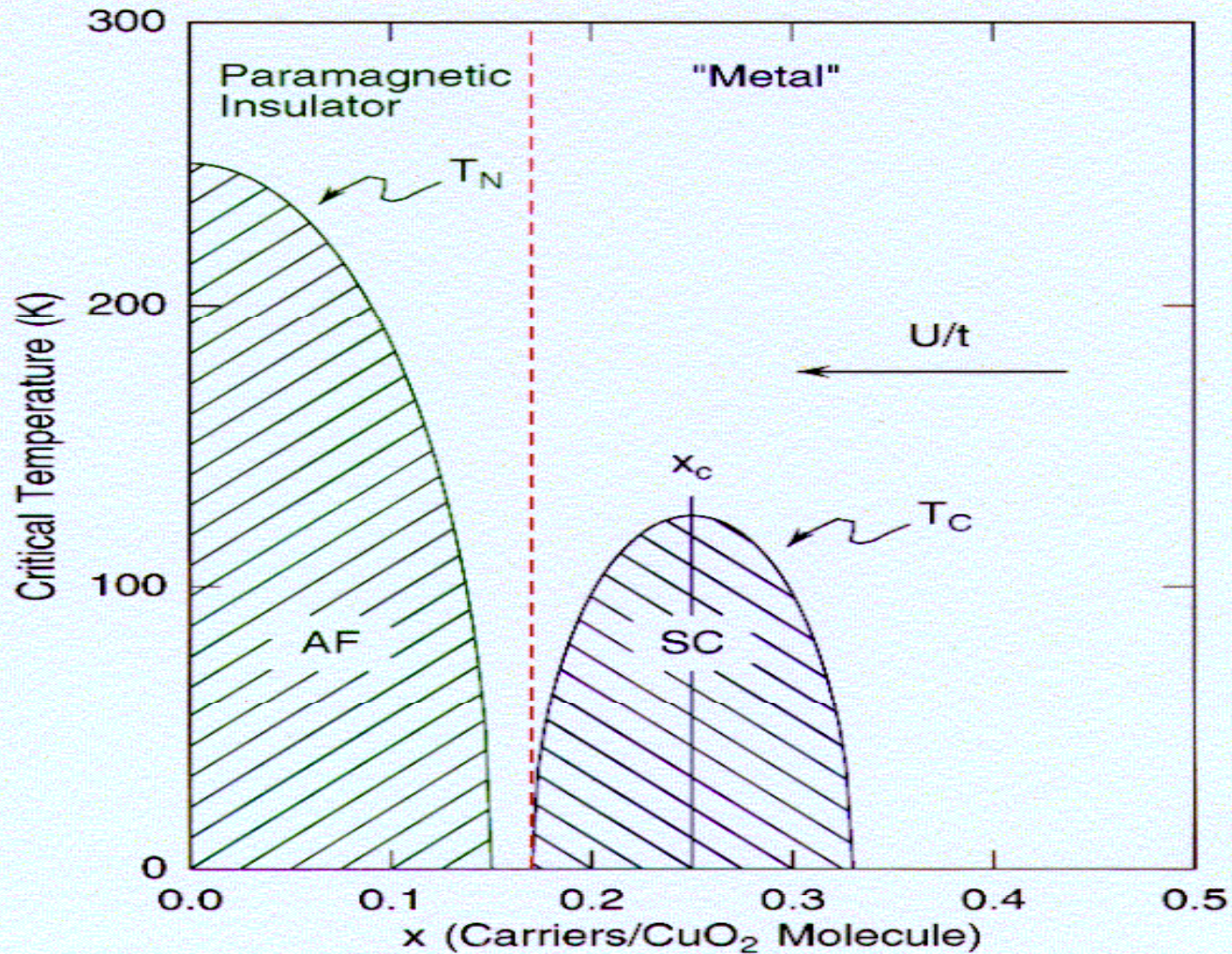
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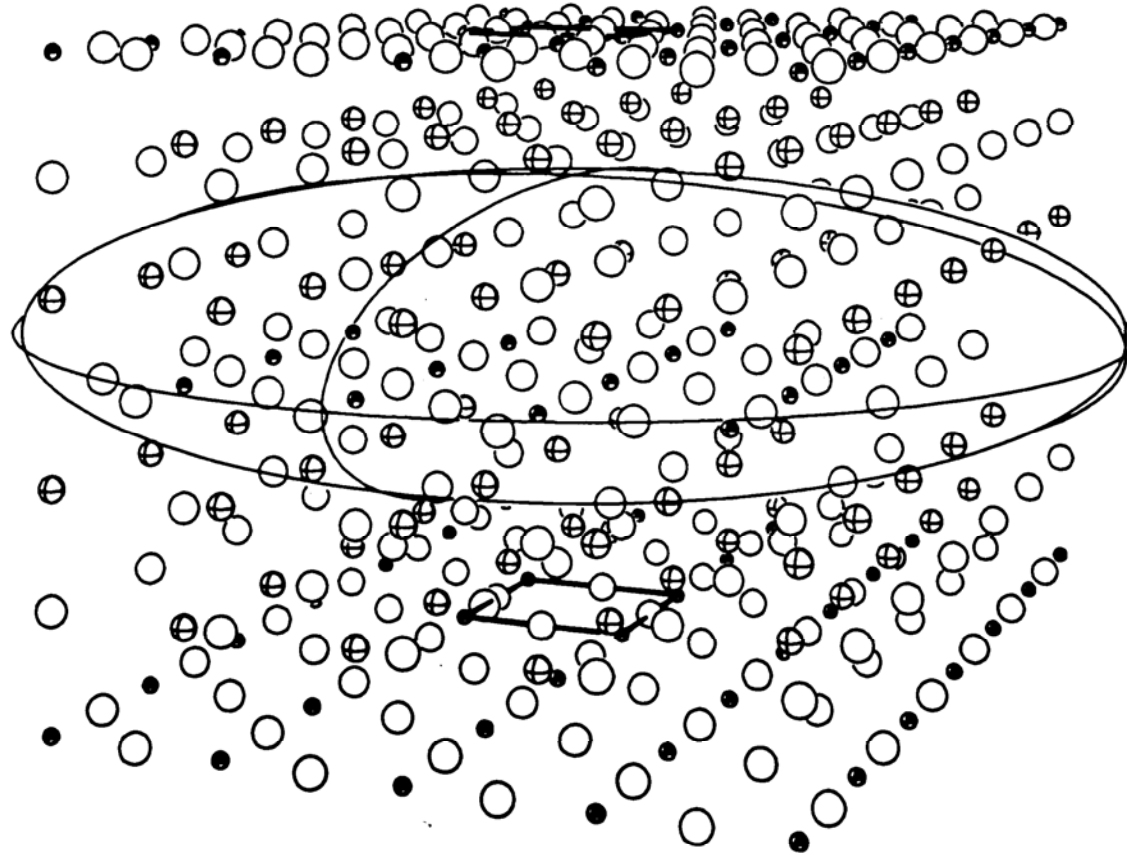
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HTSC Phase Diagram



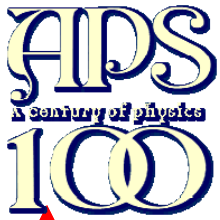
$\text{La}_{2-x}\text{Sr}_x\text{CuO}_{4-\delta}$ Coherence Ellipsoid

↖ La
 • Cu
 ○ O

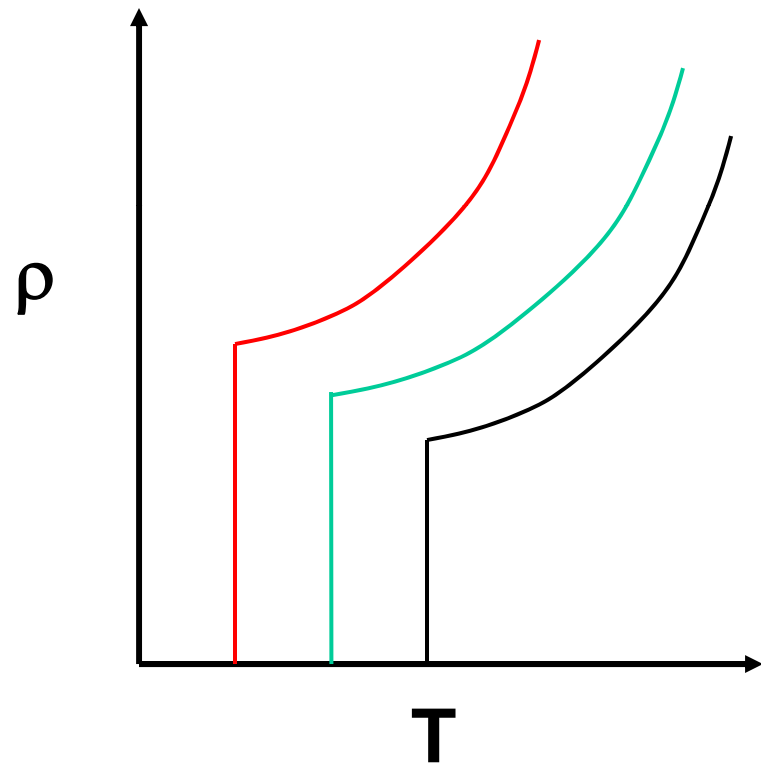
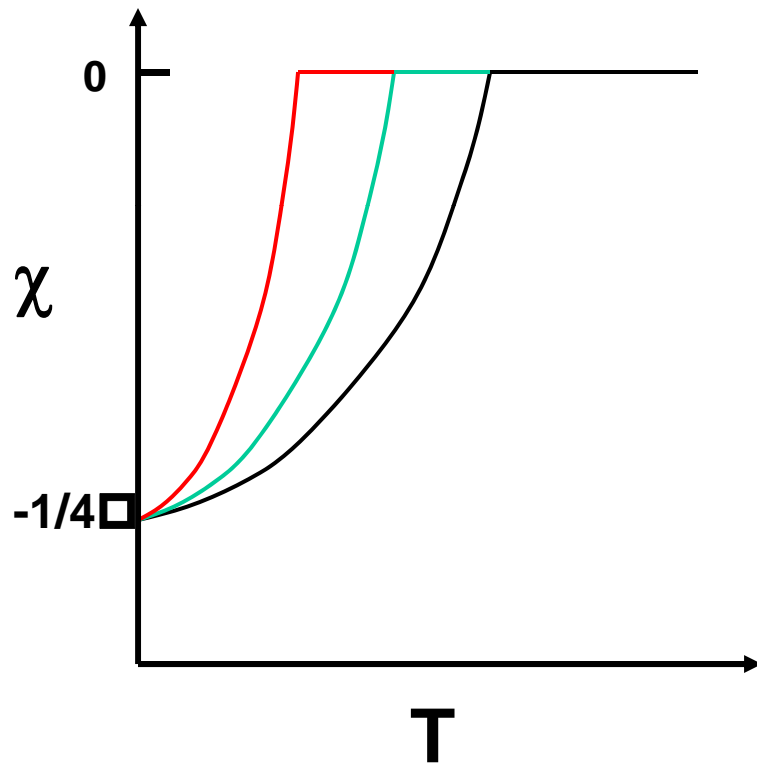


$$\boxed{\times}_{ab} = 20 \text{ \AA}$$

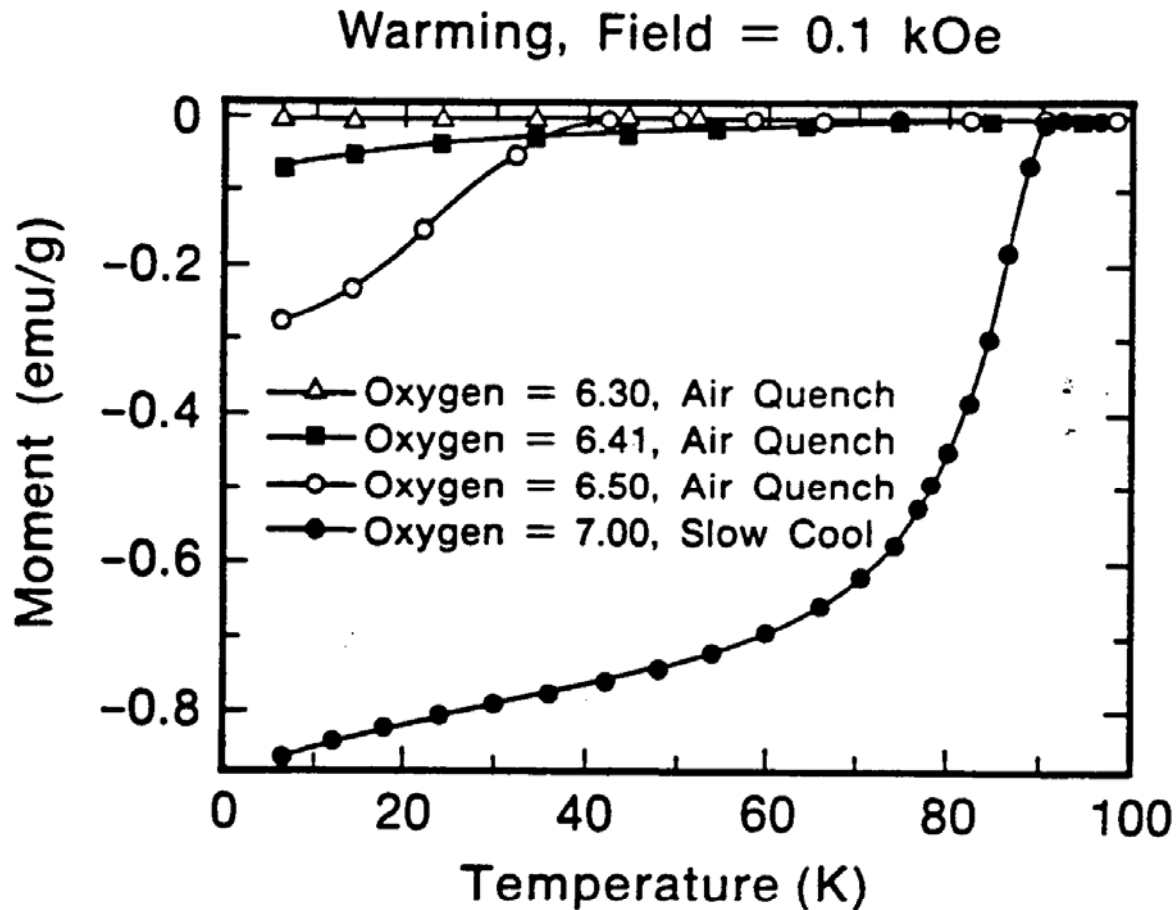
$$\boxed{\times}_c = 6 \text{ \AA}$$



Fermi Liquid Superconductors

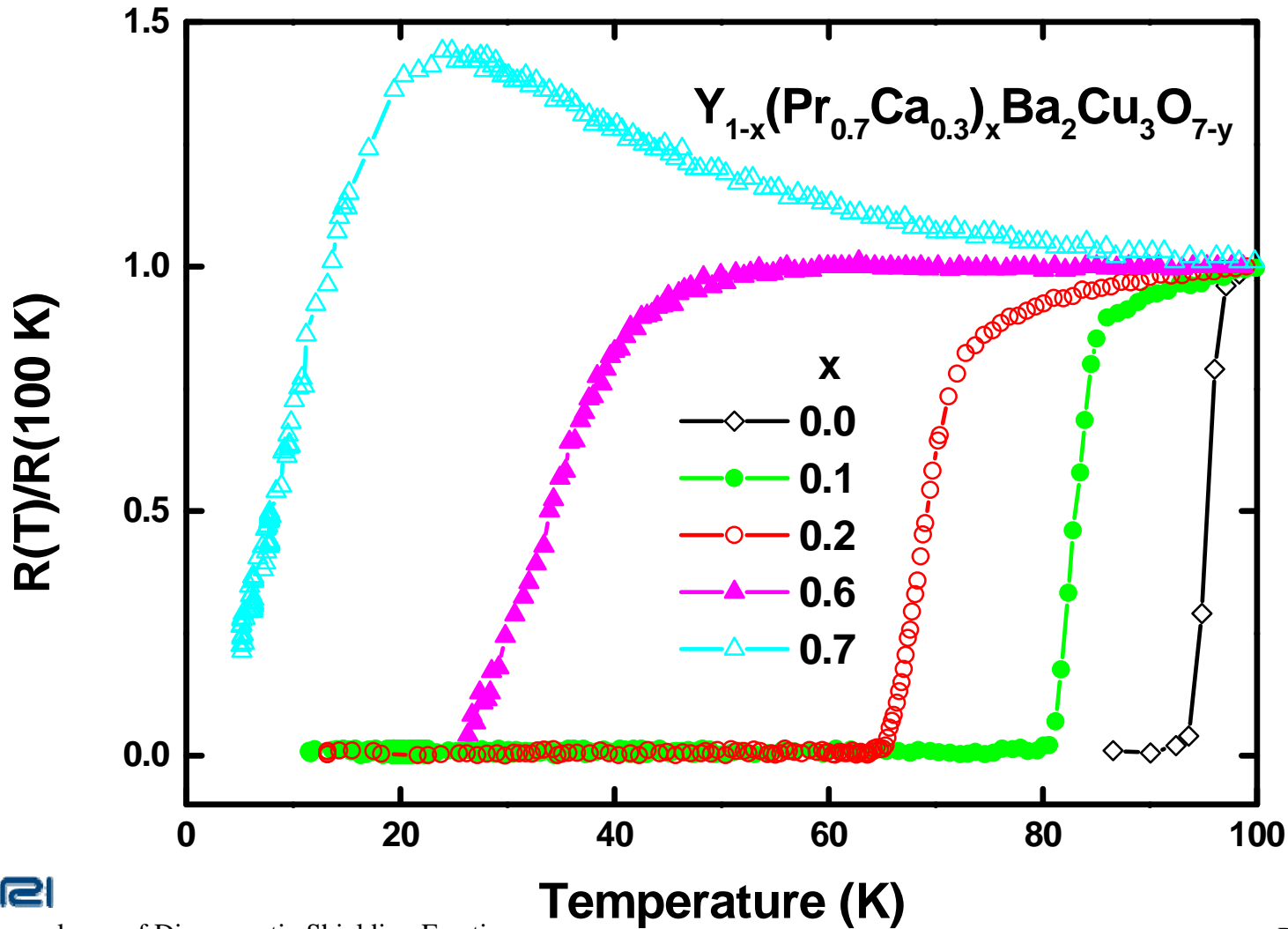


M vs. T, H
 $YBa_2Cu_3O_{7-y}$



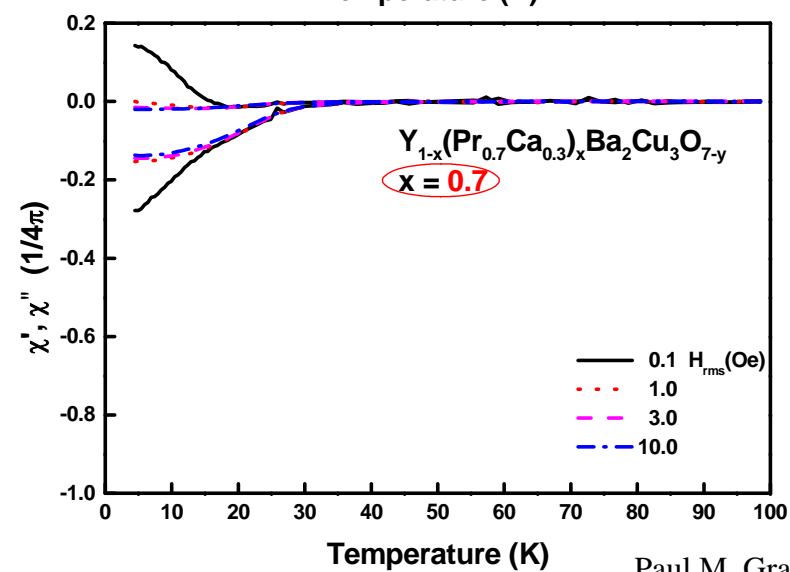
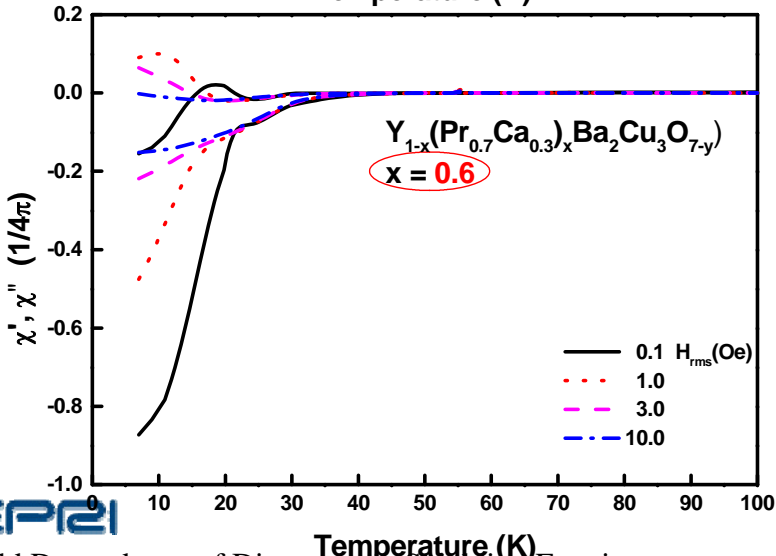
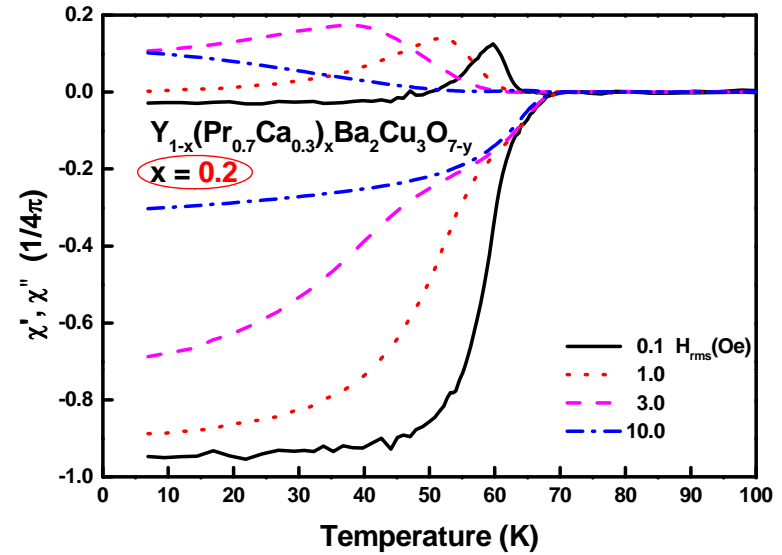
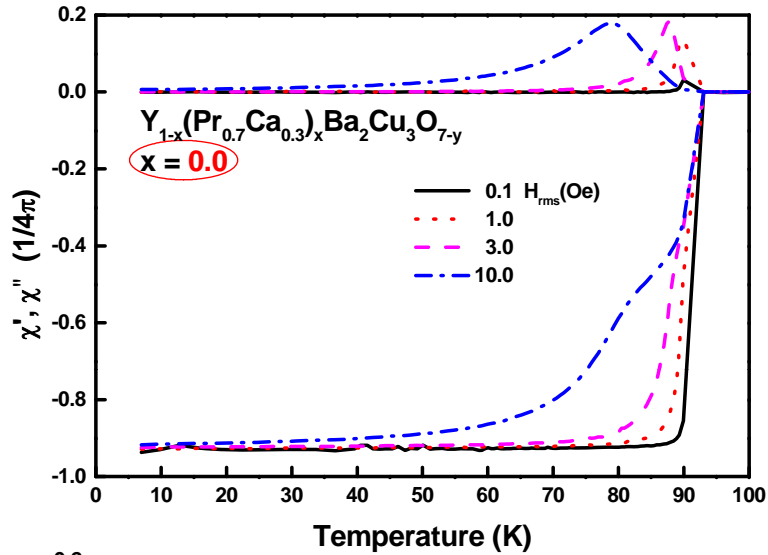
- IBM ARC Group Data: 16 March, 1987
- MRS Proc, April, 1987

R/R_{100} vs. T, H, x
 $Y_{1-x}(Pr_{0.7}Ca_{0.3})_xBa_2Cu_3O_{7-y}$

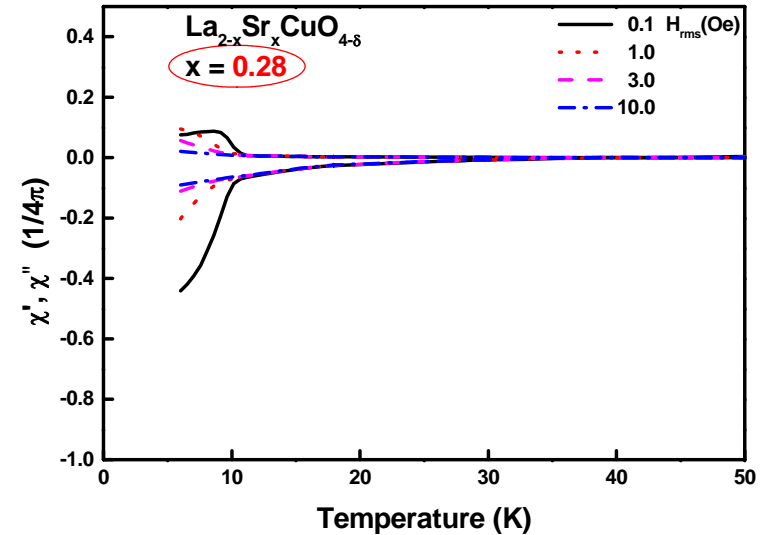
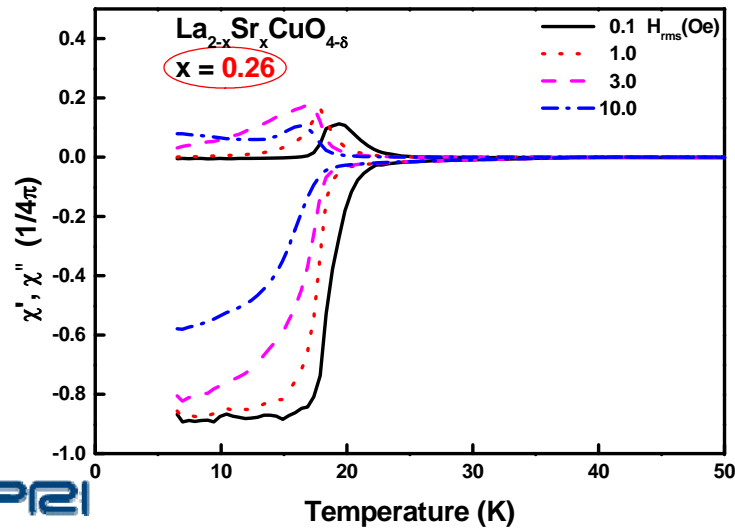
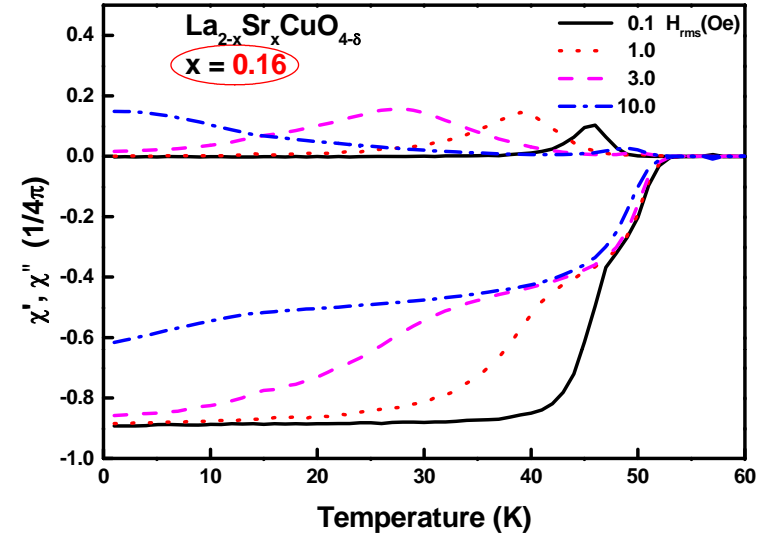
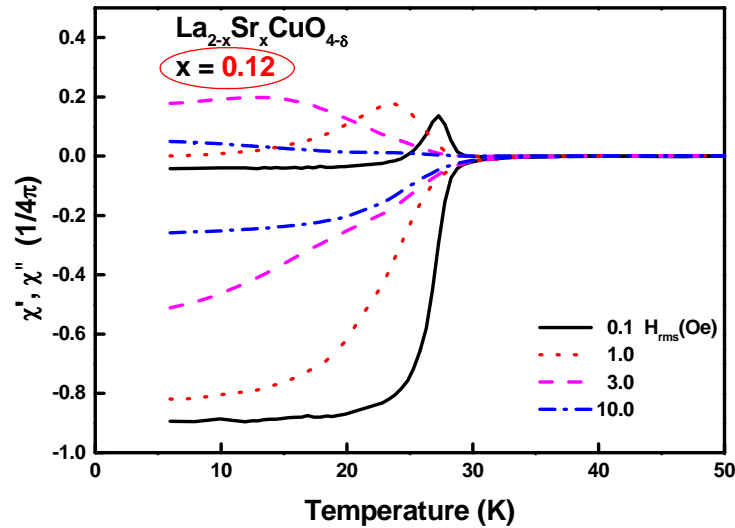


$(M', M'')_{ac}$ vs. T, H, x

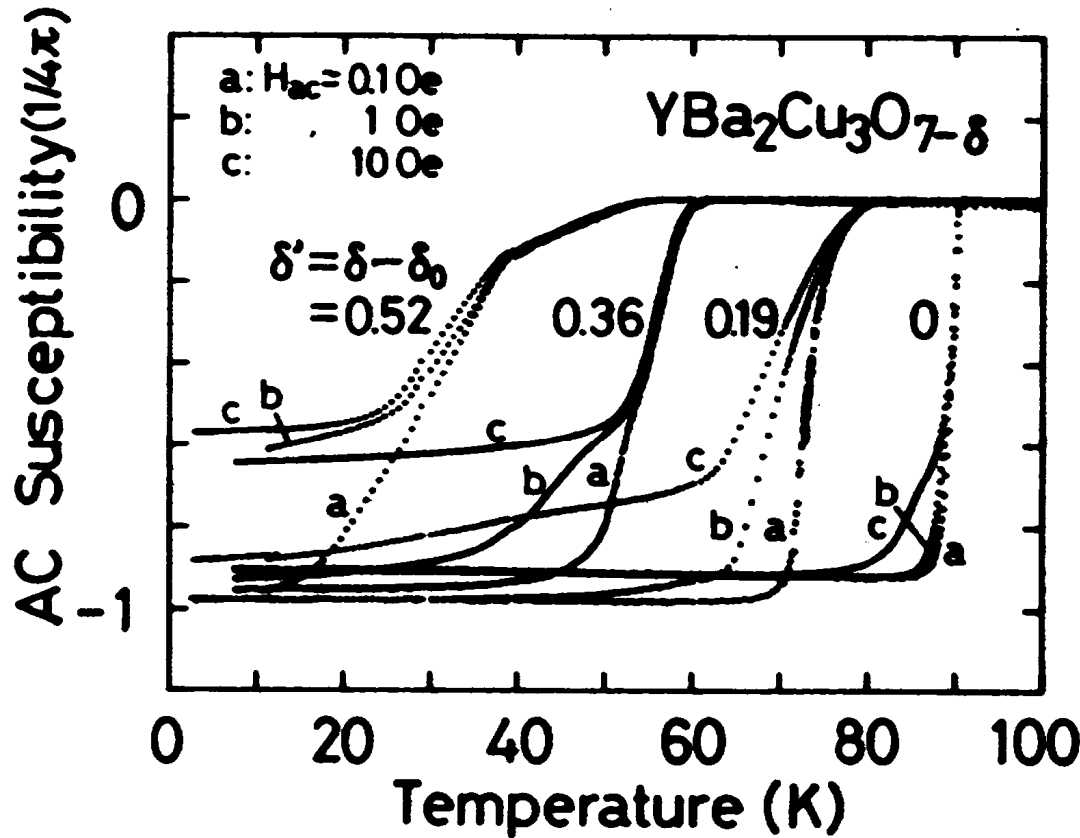
 $Y_{1-x}(Pr_{0.7}Ca_{0.3})_xBa_2Cu_3O_{7-y}$



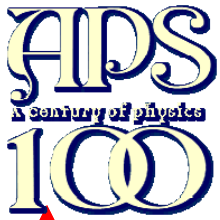
(χ', χ'') vs. T, H, x
 $\text{La}_{2-x}\text{Sr}_x\text{CuO}_{4-\delta}$



χ_{ac} vs. T, H, y
 $YBa_2Cu_3O_{7-y}$



- Kubo, et al., PRB 37, 7858 (1988){1987}.
- Early H-Field Dependence on “Carrier Concentration.”



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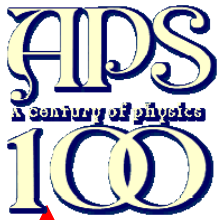
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Summary

- In moderate magnetic fields, low-T shielding limit complete only for highest T_C carrier concentrations (a universal HTSC constant?)
- For small external magnetic fields, $M_p(T \rightarrow 0) \sim -1/4 \mu_0$ at all carrier concentrations





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Conclusions

- Strong evidence for granular behavior, due to either spacial or electronic inhomogeneities, at all carrier concentrations other than optimum.
- Has this been the historical “smoking gun” pointing to the existence of stripe arrays in HTSCs?

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