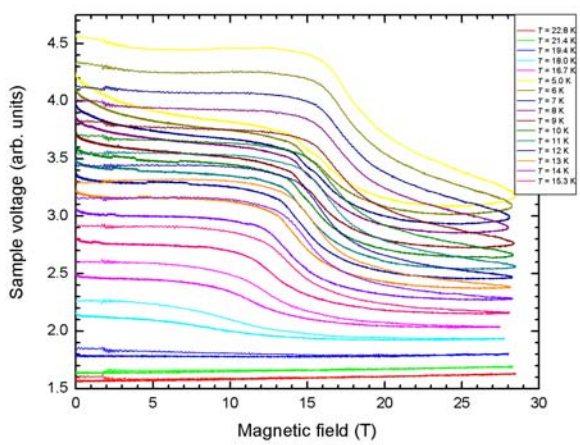
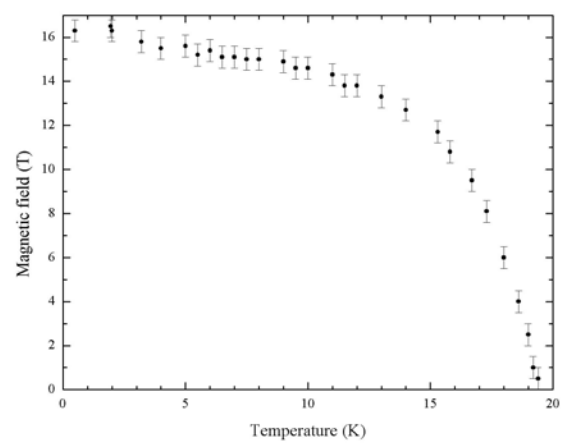
PULSED MAGNETIC FIELD MEASUREMENTS OF Na_xCoO_2

A. Kouprine (Advanced Light Source, LBNL), P. A. Goddard, J. Singleton, F. Balakirev (NHMFL, LANL).

The family of sodium cobalt oxyhydrates or oxides (cobaltites) Na_xCoO_2 (with x varying from 0.7 to 0.3) attracted a great deal of attention recently after the discovery of superconductivity around 5K in the $x \sim 0.3$ compound [1]. Though there are several clear differences in crystal and electronic structure between cobaltites and high-T_c cuprates both systems have layered crystal structure with electronic two-dimensionality (2D), and the strong electron correlations typical of a doped Mott insulator. $Na_{0.7}CoO_2$, being the host compound for this family of triangular Cobalt lattices, demonstrates its own unusual physical properties like a colossal and magnetic-field dependent thermopower [2 and references therein]. Hence, further details of the electronic interactions are highly desirable for understanding the unconventional physics of this promising class of materials.

We have made measurements of the magnetization, susceptibility and resitivity on the host compound $Na_{0.7}CoO_2$ [1] in the 60 T short pulse and 50 T mid-pulse magnets at the NHMFL, Los Alamos. An as yet unidentified and highly hysteretic phase transition has been observed in the field and temperature dependence of the inter- and intralayer resisistivities. Experiments in which the sweep rate is varied suggest that much of the hysteresis is intrinsic and not due to sample heating.





The left-hand figure shows the suspected phase transition in the signal voltage (which is proportional to the interlayer resistivity) as a function of magnetic field at several different temperatures. The right-hand figure shows the preliminary phase diagram of this unidentified state using the field at which the voltage starts to drop as the phase boundary. The experiments are ongoing.

References

[1] Takada, K., *et al*., Nature **422**, 53- (2003).
[2] Wang, Y., *et al*., Nature **423**, 425-428 (2003).