Comparison of Fluctuations in Contrasting Manganites

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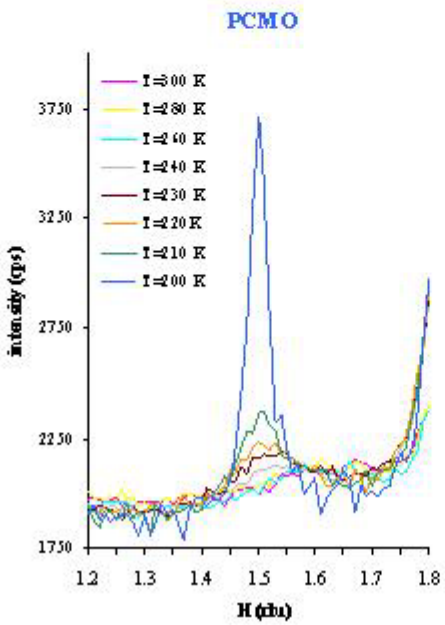
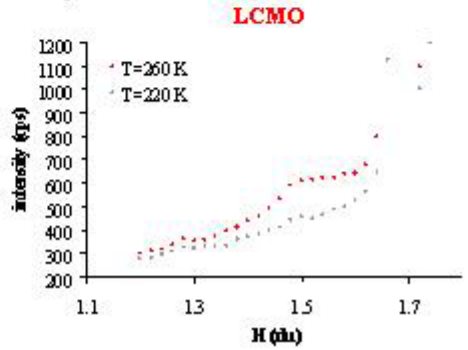
$Pr_{0.7}Ca_{0.3}MnO_3$ and $La_{0.7}Ca_{0.3}MnO_3$ are two types of perovskite manganite that exhibit different low temperature phases: antiferromagnetic insulating, and ferromagnetic metallic, respectively. By studying the fluctuations above these transitions, the nature of the different ordering transitions may be revealed.

In $Pr_{0.7}Ca_{0.3}MnO_3$, charge and orbital order fluctuations are studied near the ordering transition temperature ($T_o \approx 200$ K). Suprisingly, both types of fluctuation are observed at temperatures up to 300 K. An example of the orbital order peak and fluctuations at (1.5 2 0) are displayed to the right, at temperatures between 200-300 K.



In $La_{0.7}Ca_{0.3}MnO_3$, diffuse peaks are observed at temperatures above the transition to the ferromagnetic metallic phase, and are found to disappear abruptly upon cooling through the transition ($T \approx 250$ K). This behavior is shown below in reciprocal space scans through the (1.5 2 0) peak. The diffuse peaks are located at the same wavevector as the orbital ordering fluctuations in PCMO, but orbital ordering is precluded in LCMO by the metallic state of the low temperature phase. The fluctuations observed suggest a competition between orbital ordering and charge delocalization, with the latter effect ultimately winning out at low temperatures.



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