Contribution ID: **18** Type: **not specified**

LOCAL PROBING OF ELECTRIC AND MAGNETIC ORDER COEXISTENCE IN MANGANITE SYSTEMS

Tuesday 13 February 2007 17:45 (20 minutes)

The Mn3+/Mn4+ mixed valence manganite systems have very rich phase diagrams [1] exhibiting charge, orbital, magnetic and dielectric competing orders depending on doping, magnetic and electric applied fields, temperature and pressure. The recent interest in multiferroic materials, displaying coexistence of ferroelectricity and magnetic order has triggered further research in manganites, where phenomena such as the switching of the electric polarization by a magnetic field in TbMnO3 [2] were reported. Recently, a new mechanism that combines magnetic order and ferroelectricity was proposed by Efremov et al [3]. This mechanism is based on the charge order state that occurs in manganites, such as Pr1-xCaxMnO3, and conciliates the site versus bond-centred charge order models, which brought up much debate during the last years [4, 5, 6].
We have studied the Electrical-Field Gradients (EFG), via 111mCd/111Cd Perturbed Angular Correlations (PAC), in the Pr1-xCaxMnO3 system to achieve a better understanding on the charge ordered state (CO) and, in particular, to find out about the existence of ferroelectric order in the Pr1-xCaxMnO3 system using local probe information. The existence of a local paraelectric-to-ferroelectric discontinuous phase transition, decoupled by a few degrees from the charge order transition, is reported. Moreover, our data suggest that the charge order transition is driven by the softening of vibration modes.
Finally, the preliminary PAC experimental results on RMnO3 (R, rare-earth) multiferroic systems will be presented.

References

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Session Classification: Student Session (mixed)