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LOCAL PROBE STUDIES NEAR THE CHARGE ORDER AND MAGNETIC TRANSITIONS IN Pr1-xCaxMnO3

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The Pr1-xCaxMnO3 displays a variety of phase transitions associated with the spin, lattice, charge and orbital degrees of freedom [1],[2]. PrMnO3 and CaMnO3 are antifeerromagnetic, and low doped (x<0.32) samples are ferromagnetic below Tc~130K. For 0.32<x<0.90 the system presents a robust Charge Order state (CO) for temperatures below TCO~150-235 K and an antiferromagnetic insulator state below TN~100-180 K. Detailed real-space atomic-scale information is necessary to achieve better undertanding of such order/disorder effects.
111mCd⊠111Cd Perturbed Angular Correlation (PAC) studies were used to infer about atomic-scale distortions in the temperature range 10-600K encompassing the charge,orbital and magnetic ordering transitions. The electrical-field gradient (EFG) generated by the charge distribution around the probe shows strong anomalies when the system undergoes the charge-order transition. In particular, the principal component of the EFG (Vzz) presents a sharp discontinuity at the CO transition.

[1] Y. Tomioka et al. Phys. Rev. B 53, 1689 (1996)
[2] M. S. Reis et al., Phys. Rev. B 71, 144413 (2005)

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