Polarons and charge confinement in manganites

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We present scanning tunneling microscopy and spectroscopy studies of perovskite and bilayer manganite single crystals. Atomic resolution micrographs and temperature dependent tunneling spectroscopy both suggest that local lattice distortions (polarons) are essential ingredients in understanding the macroscopic electronic transport properties of these complex oxide materials. These experiments indicate that the metal insulator transitions associated with charge ordering in (Bi,Ca)MnO_3 and CMR in $La_{1.4}Sr_{1.6}Mn_2O_7$ can both be interpreted as a melting of small polarons.
We also address the issue of electronic phase separation using this high resolution surface probe. On suitably prepared surfaces, STM reveals mostly homogeneous surfaces, except in the vicinity of the metal insulator phase transition temperature, where inhomogeneities consistent with a first order phase transition are observed.

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