Highlights

Oxides - 2015

Electric-Field Control of the Orbital Occupancy and Magnetic Moment of a Transition-Metal Oxide

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By using soft-x-ray linear and magnetic dichroism on $La_{0.825}Sr_{0.175}MnO_3/PbZr_{0.2}Ti_{0.8}O_3$ ferromagnetic-ferroelectric heterostructures we demonstrate a non-volatile modulation of the Mn 3d orbital anisotropy and magnetic moment. X-ray absorption spectroscopy at the Mn $L_{2,3}$ edges shows that the ferroelectric polarization direction modifies the carrier density, the spin moment, and the orbital splitting of t2g and eg Mn 3d states. These results are consistent with polar distortions of the oxygen octahedra surrounding the Mn ions induced by the switching of the ferroelectric polarization.

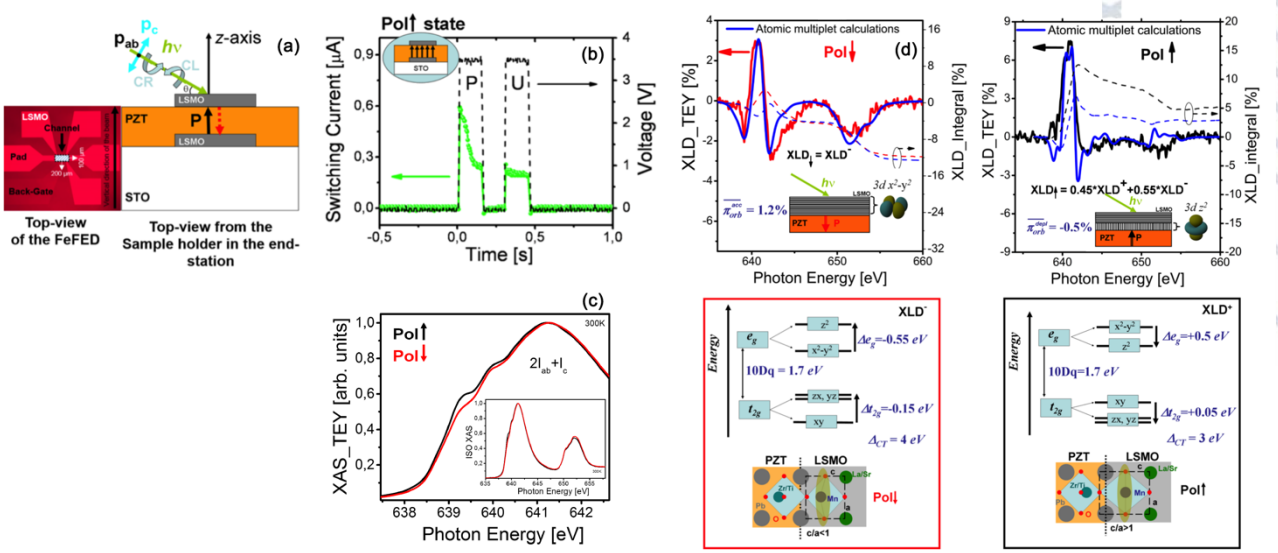

Figure: (a) Top view of the Ferroelectric Field Effect (FEFED) devices and schematic view of the XAS experiment on the LSMO/PZT/LSMO FEFED. (b) Ferroelectric switching of the PZT layer with positive voltage pulses P and U, corresponding to the Pol↑ state (P pointing toward the top LSMO layer, see inset). (c) TEY-XAS spectra of the FEFED the Polarization in two possible states. (d) XLD spectra with Pol down and (e) XLD spectra with Pol up and corresponding orbital interfacial configuration deduced from the fitting of the data using atom multiplet codes.