Hidden Magnetic Configuration in La0.7Sr0.3MnO3 Film and its Functionality in Heterostructure

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Mixed valence manganites, in which a delicate interaction between electronic, orbital, magnetic and structural degrees of freedom produces rich phase diagrams reflecting the competing, nearly-degenerate ground states, have been under intense investigation for decades. In this class of materials, La1-xSrxMnO3 is an attractive material for incorporation into spin-dependent electronic devices. Optimally doped La0.7Sr0.3MnO3 (LSMO) is among the most widely studied colossal magneto-resistance materials. It is a prototypical mixed valence perovskite exhibiting ferromagnetism mediated by double exchange and exhibits a metal to insulator transition at low temperatures. In this presentation, I will introduce our recent observations of LSMO films grown on strontium titanate (STO). Using x-ray magnetic circular dichroism, we detected a hidden behavior: a remanent magnetic state of the LSMO is reverse for the applied magnetic field. We found that this hidden behavior is due to an inhomogeneous 3d electron-distribution along surface normal direction, divided between an intermediate layer (enrich Mn3+) and a nominal mixed-valence layer of LSMO. Controlling the applied field, film thickness, and/or temperature, we can generate two different remanent states in a single LSMO film. Also, by appropriate heterostructure (BiFeO3-LSMO), I will show that our findings offer a considerable potential for application to thin-film devices, with potential for new forms of spin coupling and device functionality.