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**Domain Structures in Perovskite Oxide Superlattices**[1]

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Perovskite oxides possess a wide range of technologically relevant functional properties including ferromagnetism, ferroelectricity, and superconductivity. Furthermore, the interfaces of perovskite oxides have been shown to exhibit unexpected functional properties not found in the constituent materials. These functional properties arise due to various structural and chemical changes as well as electronic and/or magnetic interactions occurring over nanometer length scales at the interfaces. In order to understand how these interfacial effects impact the ferromagnetic (FM) properties of the half metal $La_{0.7}Sr_{0.3}MnO_3$ (LSMO), we have examined superlattices composed of LSMO sublayers alternating with either the antiferromagnetic (AFM) insulator $La_{0.7}Sr_{0.3}FeO_3$ (LSFO) or the non-magnetic metal $La_{0.5}Sr_{0.5}TiO_3$ (LSTO). A comprehensive approach consisting of bulk magnetization, magneto-transport measurements, and scanning transmission electron microscopy as well as soft x-ray magnetic spectroscopy and microscopy has been used to fully characterize the properties of the interfaces. We find that the nature of the charge transfer across the interfaces affects the FM properties of LSMO, such that at a given sublayer thickness, the LSMO/LSTO system displays a similar Curie temperature but a higher saturation magnetization than the LSMO/LSFO system. For a specific range of sublayer thicknesses, the LSMO/LSFO system displays a unique spin-flop coupling where the FM moments and the AFM spin axis maintain a perpendicular orientation relative to one another. Through this coupling mechanism, the direction of the AFM spin axis can be reoriented with an applied magnetic field. In this talk, I will discuss how these interfacial phenomena contribute to the types of FM and AFM domain patterns observed in the individual layers in the superlattices.

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