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James C. McGroddy Prize Talk: Controlling and Manipulating Ferromagnetism with an Electric Field Using Multiferroic Oxide Heterostructures

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Complex perovskite oxides exhibit a rich spectrum of functional responses, including magnetism, ferroelectricity, highly correlated electron behavior, superconductivity, etc. The basic materials physics of such materials provide the ideal playground for interdisciplinary scientific exploration. Over the past decade we have been exploring the science of such materials (for example, colossal magnetoresistance, ferroelectricity, etc) in thin film form by creating epitaxial heterostructures and nanostructures. Among the large number of materials systems, there exists a small set of materials which exhibit multiple order parameters; these are known as multiferroics. Using our work in the field of ferroelectric and ferromagnetic oxides as the background, we are now exploring such materials, as epitaxial thin films as well as nanostructures. A particularly interesting problem is that related to electric field control and manipulation of ferromagnetism. In this talk I will describe to you some aspects of such materials as well as the scientific and technological excitement in this field. Finally I will share my ideas on the most exciting open problems and emerging directions in multiferroics and beyond.