Playing with Atomic Legos: Engineering Oxide Thin Films with Novel Ferroic Properties

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The development of thin films for research and applications has undoubtedly lead to important discoveries that have advanced the understanding on the interesting physics at play in these systems. It has also resulted in an accelerated development of technological materials, particularly those with interesting and useful magnetic and electronic properties. To help meet the current and future need to understand and engineer thin film systems that can operate faster, more efficiently, or display novel functional properties grows, the development of transition metal oxides towards these aims has great potential to exceed the capabilities of current technology. One particularly interesting set of materials are the perovskite oxides, since within this "family" of materials that have different atomic compositions, but similar crystal structures, a wide variety of behaviors and physical properties can be observed. When applied to thin films, the similar crystal structures allow us to stack different materials like atomic building blocks, engineering systems with new properties by changing variables such as film thickness, epitaxial strain, and even through combining several materials in repeated layers, creating a new structure called a "superlattice". Here, I will focus on how such approaches to thin films can be used to engineer materials with novel ferroic behaviors, including ferroelectricity, ferro- and antiferromagnetism, and multiferroic systems that combine these properties.

Bio: Sara Callori is an Assistant Professor of Physics at California State University San Bernardino. She got her bachelor's degree in 2007 from New York University and earned her PhD in 2013 from Stony Brook University. Her dissertation work focused on ferroelectric oxide superlattices. She then spent two years as a post-doctoral researcher in Sydney, Australia in a joint position between the Bragg Institute and the University of New South Wales. As a post-doc she worked on studying magnetic thin film systems with neutron scattering. She is currently interested in developing thin films and superlattices that exploit properties like lattice strain in order to engineer novel magnetic materials, particularly multiferroics. When not doing physics she watches too much bad TV with her husband Jason, son Hamish, and two dogs, Mr. Taco and Otis. She once came in second place on Jeopardy! and tweets at @SaraDoesScience.