replacing MAR16-2015-006087 Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Interfacial Symmetry Control of Emergent Ferromagnetism

ALEXANDER GRUTTER, JULIE BORCHERS, BRIAN KIRBY, Natl Inst of Stds and Tech , CHUNYONG HE, University of California, Berkeley, ELKE ARENHOLZ, Lawrence Berkeley National Lab, ARTURAS VAILIONIS, CHARLES FLINT, YURI SUZUKI, Stanford University — Atomically precise complex oxide heterostructures provide model systems for the discovery of new emergent phenomena since their magnetism, structure and electronic properties are strongly coupled. Octahedral tilts and rotations have been shown to alter the magnetic properties of complex oxide heterostructures, but typically induce small, gradual magnetic changes. Here, we demonstrate sharp switching between ferromagnetic and antiferromagnetic order at the emergent ferromagnetic interfaces of $CaRuO_3$/$CaMnO_3$ superlattices. Through synchrotron X-ray diffraction and neutron reflectometry, we show that octahedral distortions in superlattices with an odd number of $CaMnO_3$ unit cells in each layer are symmetry mismatched across the interface. In this case, the rotation symmetry switches across the interface, reducing orbital overlap, suppressing charge transfer from Ru to Mn, and disrupting the interfacial double exchange. This disruption switches half of the interfaces from ferromagnetic to antiferromagnetic and lowers the saturation magnetic of the superlattice from 1.0 to 0.5 μ_B/interfacial Mn. By targeting a purely interfacial emergent magnetic system, we achieve drastic alterations to the magnetic ground state with extremely small changes in layer thickness.

Alexander Grutter
NIST - Natl Inst of Stds
Tech

Date submitted: 06 Nov 2015 Electronic form version 1.4