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Magnetism and electronic order in $SmTiO_3$ quantum well heterostructures RYAN NEED, PATRICK MARSHALL, BRANDON ISAAC, Materials Department, University of California Santa Barbara, EUGEN WESCHKE, BESSY-II, Helmholtz Zentrum Berlin, ANDREAS SUTER, Swiss Muon Source, Paul Scherrer Institute, MICHAEL GRAF, Physics Department, Boston College, SUSANNE STEMMER, STEPHEN WILSON, Materials Department, University of California Santa Barbara — Complex oxide heterostructures that possess high density interfacial electron gases due to charge discontinuities between neighboring layers provide a unique platform with which to study correlated electron physics. In heterostructures containing band insulator $SrTiO_3$ and Mott insulating rare earth titanate layers, it has been shown that tuning relative layer thicknesses can in turn tune both the electronic and magnetic properties found in each layer type, leading to exotic metal-insulator transitions and electronic symmetry breaking in the interleaving quantum wells. Here we use a combination of resonant x-ray reflectometry (RXR), polarized neutron reflectometry (PNR), and muon spin rotation (muSR) to probe the electronic and magnetic properties of $SmTiO_3$ thin films and $SrTiO_3$-$SmTiO_3$ heterostructures. RXR measurements demonstrate the effect of tuning both $SrTiO_3$ and $SmTiO_3$ layer thicknesses on the electronic structure, and our combined PNR and muSR results resolve the freezing of interface-induced free electrons within the $SrTiO_3$ quantum wells below a critical temperature. The correlations between our scattering results and previously reported anomalous transport in $SrTiO_3$-$SmTiO_3$ heterostructures will be discussed.

Ryan Need
Materials Department, University of California Santa Barbara

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