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Magnetism in Complex Oxide Heterostructures Determined with Neutron Scattering[1]

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With the creation of high quality superlattices consisting of complex oxide materials novel materials exhibiting a wide range of interesting phenomena are emerging. Due to the diverse physical properties of complex oxides, (e.g., ferromagnetism, antiferromagnetism, superconductivity), some of which can be varied by doping, the versatility in their applications is large. The physical properties in these new materials, often is tied to the behavior at the interfaces between the different components of the superlattice, and therefore requires detailed knowledge of the relationship between the chemical and electronic composition. Polarized neutron reflectometry (PNR) provides access to the depth-dependent magnitude and orientation of the magnetization and can therefore link the magnetic to the electronic and chemical properties, especially close to these interfaces. Several examples of our work will be presented, including that on $La_{0.7}Ca_{0.3}MnO_3$/ $YBa_2Cu_3O_{7-\delta}$/ $La_{0.7}Ca_{0.3}MnO_3$ trilayers which exhibit the inverse superconducting spin switch behavior, and where suppression of the magnetization close to the interface, as well as a varying anisotropy axis have been determined [1]. Another example is work on digitally layered analogs of $La_{1-x}Sr_xMnO_3$, where PNR reveals an asymmetric distribution of the magnetization across the two components (antiferromagnetic) $LaMnO_3$and $SrMnO_3$, which has been linked to structural properties at the interfaces [2].

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