Title:	Carrier-driven coupling in ferromagnetic oxide heterostructures
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Keywords:	metal oxides magnetic and electrical properties heterostructure geometries spintronics
Issue Date:	2017
Publisher:	APS
Citation:	Physical Review B, 96 (18)
Abstract:	Transition metal oxides are well known for their complex magnetic and electrical properties. When brought together in heterostructure geometries, they show particular promise for spintronics and colossal magnetoresistance applications. In this article, we propose a carrier-driven coupling mechanism in heterostructures composed of itinerant ferromagnetic materials. The coupling is mediated by charge carriers that strive to maximally delocalize through the heterostructure to gain kinetic energy. In doing so, they force a ferromagnetic or antiferromagnetic coupling between the constituent layers. To illustrate this, we focus on heterostructures composed of SrRuO3 and La1−xAxMnO3 (A = Ca/Sr). Using the minority-carrier nature of SrRuO3, we provide a simple explanation for antiferromagnetic alignment that is known to occur in multilayers. We present a phenomenological Kondo-lattice model which reproduces the known magnetization properties of multilayers. In addition, we discuss a quantum well model for heterostructures and argue that the spin-dependent density of states determines the nature of the coupling. As a smoking gun signature, we propose that bilayers with the same constituents will oscillate between ferromagnetic and antiferromagnetic coupling upon tuning the relative thicknesses of the layers. We present ab initio results that support this prediction.
Description:	Authors sequences are not necessary in order
URI:	https://journals.aps.org/prb/abstract/10.1103/PhysRevB.96.184408 (https://journals.aps.org/prb/abstract/10.1103/PhysRevB.96.184408) http://hdl.handle.net/123456789/1762 (http://hdl.handle.net/123456789/1762)
Appears in Collections:	Research Articles (/jspui/handle/123456789/9)