Abstract Submitted
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Theory for magnetic exchange and anisotropy at the $LaAlO_3/SrTiO_3$ interface[1] SUMILAN BANERJEE, ONUR ERTEN, MOHIT RANDERIA, Department of Physics, The Ohio State University, Columbus, Ohio, 43210 — The $LaAlO_3/SrTiO_3$ interface exhibits unusual magnetic properties with a large density of local moments seen by both torque and scanning SQUID experiments. We develop a model where local moments are formed on a 2D checkerboard lattice due to correlation-driven charge ordered insulator. We focus on the double exchange interaction of these moments via conduction electrons with a large Rashba spin-orbit coupling (SOC) due to broken inversion at the interface. We derive an effective Hamiltonian for the local moments that has an unusual double square-root ferromagnetic exchange, previously seen in a different context [1]. Two new features arise from SOC, direction-dependent anisotropic exchanges and Dzyaloshinskii-Moriya type terms, which can be tuned by gating. We show that SOC accounts for the the unusually large easy-plane magnetic anisotropy seen in experiment. We will explore the phase diagram, as a function of the strength of Rashba SOC, to see what unusual magnetic states might be stabilized. We will comment on the possibility of reconciling the apparently different conclusions reached by torque and scanning SQUID measurements regarding the magnetic ordering and ordered moment.

[1] O. Erten et al., Phys. Rev. Lett. 107, 257201 (2011).

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