Magnetism of LaAlO$_3$/SrTiO$_3$ Heterostructure Interface

LU LI$^1$, Department of Physics, Massachusetts Institute of Technology, C. RICHTER, University of Augsburg, D-86135 Augsburg, Germany, J. MANNHART, Max Planck Institute for Solid State Research, 70569 Stuttgart, Germany, R.C. ASHOORI, Department of Physics, Massachusetts Institute of Technology — The LaAlO$_3$/SrTiO$_3$ heterostructure is a potential candidate for a high mobility two-dimensional electron system with novel electronic and magnetic properties. Magnetic ordering has been proposed to arise from d-shell electrons transferred by the polarization discontinuity at the interface. However, the magnetization of this system cannot easily be detected with standard techniques due to the small volume of the interfacial region. Using torque magnetometry, we measure the magnetic moment of the interface system directly. Our results indicate the existence of a magnetic ordering at the two-dimensional conductive interface. The ferromagnetic-like ordering state persists up to 200 K. Such a state is hardly explained by ion-exchange at the interface, since LaTiO$_3$ is antiferromagnetic. Moreover, the same magnetic behavior persists even when the sample is superconducting, which suggests an unconventional two-dimensional superconducting phase.

$^1$Current address: University of Michigan, Dept. of Physics