

Magnetotransport properties of 2DEG formed in LAO/ETO/STO heterostructures studied using the electric field effect

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In 2004 Ohtomo and Hwang [1] reported the formation of a high mobility 2-dimensional electron gas (2DEG) at the interface between two wide bandgap insulators oxides, namely LaAlO_3 (LAO) and SrTiO_3 (STO). In this work, we show that the 2DEG created at the LAO/STO interface becomes both electric-field-tunable spin polarized and superconducting by introducing a few atomic layers of EuTiO_3 (ETO) which is an antiferromagnetic (AF) insulator iso-structural to STO [2]. Among the most interesting characteristics of this 2DEG are the remarkably large Rashba-spin-orbit interactions and unconventional superconductivity and magnetism, possibly related to the presence of strong correlations in quantum-confined 3d-bands [3]. The occurrence of magnetic interactions, superconductivity and spin-orbit interactions in the same 2DEG system makes the LAO/ETO/STO an intriguing platform for the emergence of novel quantum phases in low-dimensional devices. The main goal of this work was to investigate the electrical transport of the LAO/ETO/STO interface and to shed more light on the complex nature of this system and its phase diagram. In particular, we focused on the interplay between Rashba-spin-orbit interactions and ferromagnetism. In fact, the LAO/ETO/STO 2DEG is one of the few systems where such interplay can be studied and it is therefore of great interest for future spintronic applications.

[1] A. Ohtomo and H. Y. Hwang, "A high-mobility electron gas at the $\text{LaAlO}_3/\text{SrTiO}_3$ heterointerface." *Nature* 427, (2004);

[2] G. M. De Luca, D. Stornaiuolo et al. "Transport properties of a quasi two-dimensional electron system formed in $\text{LaAlO}_3/\text{EuTiO}_3/\text{SrTiO}_3$ heterostructures", *Phy. Rev. B* 89, 224413 (2014);

[3] D. Stornaiuolo et al. "Tunable spin polarization and superconductivity in engineered oxide interfaces", *Nature Mat.* 10.1038 4491 (2015).

The lecture will be held in English.

Cordially invited to attend.

