Contribution ID: **55** Type: **not specified**

2-dimensional electron gases in oxide heterostructures

Wednesday, 27 November 2013 09:00 (30 minutes)

Oxide materials display within the same family of compounds a variety of exciting electronic properties ranging from ferroelectricity to ferromagnetism and superconductivity. These systems are often characterized by strong electronic correlations, complex phase diagrams and competing ground states. This competition makes these materials very sensitive to external parameters such as pressure or magnetic field. An interface, which naturally breaks inversion symmetry, is a major perturbation and one may thus expect that electronic systems with unusual properties can be generated at oxide interfaces. A striking example is the interface between LaAlO3 and SrTiO3, two good band insulators, which was found in 2004 to be conducting [1], and, in some doping range, superconducting with a maximum critical temperature of about 200 mK [2]. The characteristics observed in the normal and superconducting states are consistent with a two-dimensional electronic system.

In this presentation, I will briefly motivate the search for novel properties at oxide interfaces before to focus on the 2-dimensional electron gas observed in at the LaAlO3/SrTiO3 interface. The thickness of the electron gas is found to be a few nanometers at low temperatures. This electron gas with low electronic density, typically 5 10ˆ13 electrons/cm2, and naturally sandwiched between two insulators is ideal for performing electric field effect experiments allowing the carrier density to be tuned. I will discuss the origin of the electron gas [3]; field effect experiments and the phase diagram of the system [4]; superconductivity and the role of spin orbit [5,6]; and if time allows the physics of high mobility samples that display Shubnikov de Haas oscillations [7].

[1] A. Ohtomo, H. Y. Hwang, Nature 427, 423 (2004).

[2] N. Reyren, S. Thiel, A. D. Caviglia, L. Fitting Kourkoutis, G. Hammerl, C. Richter, C. W. Schneider, T. Kopp, A.-S. Ruetschi, D. Jaccard, M. Gabay, D. A. Muller, J.-M. Triscone and J. Mannhart, Science 317, 1196 (2007).

[3] M.L. Reinle-Schmitt, C. Cancellieri, D. Li, D. Fontaine, S. Gariglio, M. Medarde, E. Pomjakushina, C.W. Schneider, Ph. Ghosez, J.-M. Triscone, and P.R. Willmott, Nature Communications, 3, 932 (2012).

[4] A. Caviglia, S. Gariglio, N. Reyren, D. Jaccard, T. Schneider, M. Gabay, S. Thiel, G. Hammerl, J. Mannhart, and J.-M. Triscone, Nature 456, 624 (2008).

[5] A.D. Caviglia, M. Gabay, S. Gariglio, N. Reyren, C. Cancellieri, and J.-M. Triscone, Physical Review 104, 126803 (2010).

[6] A. Fête, S. Gariglio, A. D. Caviglia, M. Gabay, J.-M. Triscone, Physical Review B (RC) 86, 201105 (2012).

[7] A.D. Caviglia, S. Gariglio, C. Cancellieri, B. Sacépé, A.Fête, N. Reyren, M. Gabay, A.F. Morpurgo, J.-M. Triscone, Physical Review Letters 105, 236802 (2010).

Primary author: TRISCONE, Jean-Marc (DPMC, University of Geneva)

Presenter: TRISCONE, Jean-Marc (DPMC, University of Geneva)

Session Classification: Applications I