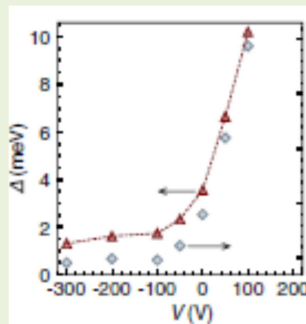


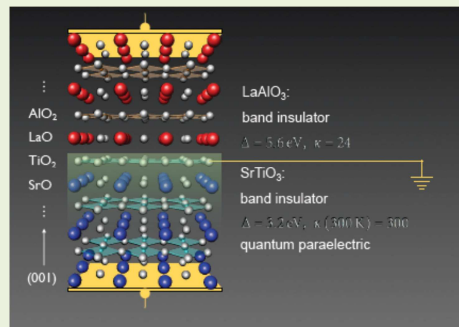
## Tuning a Rashba spin-orbit interaction at oxide interfaces

M.Gabay (LPS), A.D Caviglia, S.Gariglio, N.Reyren, C.Cancellieri, J.M Triscone (U. Geneva)

The discovery of two-dimensional electron gases (2DEGs) at the surface or interface of band insulating perovskite oxides could soon herald the birth of a new electronic-based industry, coined oxitronics. Experiments revealed the existence of 2DEGs at the surface of  $\text{KTaO}_3$  (KTO) and of  $\text{SrTiO}_3$  (STO) and at the interface between  $\text{LaAlO}_3$  (LAO) and STO, where the electronic structure of the parent compounds displays large gaps between the valence and conduction bands. The bulk of these systems is insulating, as evidenced by the temperature dependence and extremely high values of the electrical resistance at low temperature as well as by the optically transparent aspect of the crystals; yet a nanometer thick metallic layer is observed at the boundary, in transport and in X-ray photoemission. Our analysis of magnetotransport data collected in experiments performed on the LAO-STO heterostructure, unveils the existence of a Rashba (interfacial) spin-orbit contribution.



Spin-orbit energy vs gate voltage



Gated LaO-STO sample

Applying a gate electric field allows one to tune the size of the spin-orbit splitting to values comparable to the Fermi energy of the 2DEG. We modeled this unusual property, which is of paramount importance in several respects. One is that it paves the way for the engineering of spin-controlled oxitronic devices. Two is that we show that this Rashba term protects the carriers against localization effects caused by non-magnetic disorder in the two-dimensional conducting channel. Three is that we bring into light the changes in the morphology of the Fermi surface which are caused by the spin-orbit term, in a broad range of gate voltages. We established that two types of carriers contribute to the conductivity in the channel, one with high mobility and other with low mobility and that the magnetic field may turn on and off selectively the high mobility contribution. As a result, a magnetic field applied in the plane of the interface will act like a switch.

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