SOCIÉTÉ CHIMIQUE DE GENÈVE

New phenomena at oxide interfaces

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At interfaces between complex oxides, electronic systems with unusual properties can be generated [1]. A striking example is the interface between $LaAlO_3$ and $SrTiO_3$, two good *insulating* perovskite oxides, which was found in 2004 to be conducting with a high mobility [2].
We recently discovered that the ground state of this system is a superconducting condensate, with a critical temperature of about 200 mK [3]. The characteristics observed for the superconducting transitions are consistent with a two-dimensional superconducting sheet as thin as a few nanometers. Recent field effect experiments revealed the sensitivity of the normal and superconducting states to the carrier density. In particular, the electric field allows the tuning of the critical temperature between 200 mK and 0 K and thus the on-off switching of superconductivity, revealing a complex phase diagram and a superconductor to insulator transition [4].
I will discuss the perspectives opened by this new field of research sometimes called “oxide interface engineering”.

[1] See for instance “When oxides meet face to face”. E. Dagotto, Science **318**, 1076 (2007).
[2] “A high mobility electron gas at the $LaAlO_3/SrTiO_3$ heterointerface”. A. Ohtomo et al., Nature **427**, 423 (2004).
[3] “Superconducting interfaces between insulating oxides”. N. Reyren et al., Science **317**, 1196 (2007).
[4] “Electric field control of the $LaAlO_3/SrTiO_3$ interface ground state”. A. Caviglia et al., Nature **456**, 624 (2008).

Conférence présentée le :

LUNDI 23 MARS 2009 À 17H30

Université de Genève – Bâtiment Sciences II

Auditoire P.-F. Tingry (A150)

30, quai Ernest–Ansermet, Genève

LA CONFÉRENCE EST PUBLIQUE

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