



CEA – Saclay, 91191 Gif-sur-Yvette Cedex  
Service de Physique de l'Etat Condensé - UMR 3680

## SÉMINAIRE

Mercredi 7 mars 2018 à 11h15

Orme des Merisiers SPEC, Salle Itzykson, Bât.774

### Chéryl FEUILLET-PALMA

LPEM - UMR8213/CNRS - ESPCI Paris – UPMC - PSL University, France

### Superconductivity and Rashba spin-orbit coupling in LaAlO<sub>3</sub>/SrTiO<sub>3</sub> interfaces

LaAlO<sub>3</sub>/SrTiO<sub>3</sub> types of heterostructures present the unique feature to host a gate tunable superconducting electron gas confined in a quantum well at the interface between two insulating oxides [1]. Remarkably, the gas also coexists with both magnetism [2] and strong Rashba spin-orbit coupling [3]. This makes a candidate system for accommodating Majorana fermions.

During this talk, I will discuss two experiments developed in our group to investigate LaAlO<sub>3</sub>/SrTiO<sub>3</sub> interfaces by dc and ac electronic transport. The first one gives clues to understand both the origin of superconductivity and the nature of the transition to the normal state over the whole doping range. I will present a resonant microwave transport experiment that enables us to extract the superfluid stiffness and the superconducting gap energy of the LaAlO<sub>3</sub>/SrTiO<sub>3</sub> interface as a function of carrier density. The analysis of the superfluid density reveals that the superconducting phase diagram of this system is controlled by the competition between electron pairing and phase coherence and that only a very small fraction of the electrons condenses into the superconducting state [4].

A second important peculiarity of these interfaces lies in the possibility to control their electronic properties, including superconductivity and spin-orbit coupling (SOC) with electrostatic field effect [5,6]. I will review several field-effect experiments, which aims at controlling the properties of the 2-DEG in top-gated devices [7,8], including the recent realization of a quantum point contact nano-device.

[1] A. D. Caviglia et al. *Nature* **456**, 624 (2008).

[2] J. Bert, et al. *Nature Phys.* **7**, 767771 (2011).

[3] A. D. Caviglia et al. *Phys. Rev. Lett.* **104**, 126803 (2010).

[4] G. Singh et al. *Nature Comm.* **9**, 407 (2018)

[5] J. Biscaras et al, *Nature Comm.* **1** (2010)

[6] J. Biscaras et al, *Phys. Rev. Lett.* **108**, 247004 (2012)

[7] S. Hurand et al. *Sci. Rep.* **1**, (2015).

[8] S. Hurand et al. *Appl. Phys. Lett.* **108**, 052602 (2016).

A coffee break will be served at 11h00. The seminar will be given in English.

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