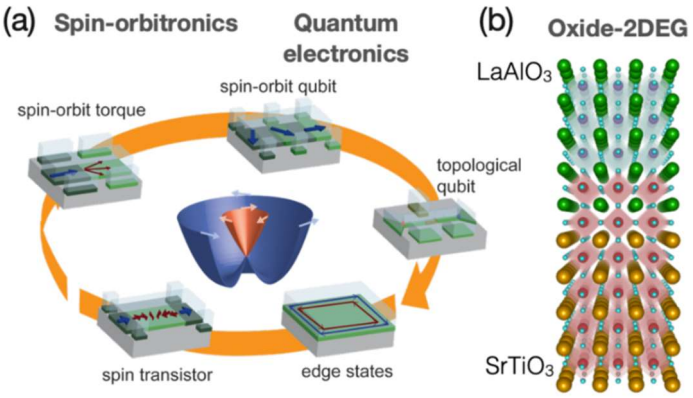
Unité Mixte de Physique CNRS/Thales, Université Paris-Saclay, 91767 Palaiseau

Post-doctoral researcher position: Quantum devices based on oxide 2-dimensional electron gases

Oxide interfaces often display unexpected phases arising from charge, spin and orbital reconstruction in a non-centrosymmetric environment. Paradigmatic examples include the two-dimensional electron gases (2DEGs) forming in $SrTiO_3$ (STO) and $KTaO_3$ (KTO) when these materials are interfaced with insulating oxides such as $LaAlO_3$ (LAO) or AlO_x. These 2DEGs are superconducting (up to 2 K for (111)-oriented KTO), possess high electron mobilities and display Rashba spin-orbit coupling (SOC) that may be harnessed to perform spin-charge interconversion.

We propose an ambitious research program to explore the physics of oxide 2DEGs with a view towards their application in quantum technologies. We have identified oxide 2DEGs as promising candidates for the definition of quantum dots to be used as spin-qubits whose readout will take advantage of Rashba SOC. The candidate will grow the samples and participate in the design and characterization of the quantum dots in collaboration with external partners. In parallel, the project will focus on hetero- and meso-structures (quantum point contacts, tunnel junctions, Josephson junctions, SQUIDs, etc) whose investigation should shed light on the nature of the normal and superconducting states, on their connection with Rashba SOC and will clarify the potential of oxide 2DEGs as platforms for nonreciprocal electronics and topological quantum computing. The candidate will prepare the samples and lead the magnetotransport experiments.



(a) Spin-orbitronic and quantum electronic devices deriving from emergent phenomena at interfaces characterized by strong Rashba SOC (b) Structure of LAO/STO heterostructures.

The project will take place in the Oxitronics group of the Unité Mixte de Physique CNRS/Thales (U. Paris-Saclay, Palaiseau), a world-leading laboratory in condensed matter physics and the cradle of spintronics. The Oxitronics group has a long experience in oxide electronics and spintronics, from sample growth (with a unique UHV cluster combining multiple growth and characterization chambers), device patterning (UV, e-beam), characterization (XRD, scanning probe microscopy) and magnetotransport. The work will be done in strong partnership with the group of Nicolas Bergeal from the LPEM of ESPCI (Paris). Both teams have a long history of collaboration with multiple joint publications in high profile journals. The position will be financed by the IQARO EU project gathering labs from Salerno, Naples, Copenhagen, Göteborg, Paris and Krakow with the French companies Thales and RIBER.

Scientific skills: Required: Condensed matter physics, electron transport, quantum transport, quantum physics, superconductivity; Recommended: physics of oxide materials, spintronics, spin-charge interconversion

Technical skills: Required: magnetotransport (dc, ac, rf), cryogenics, data analysis with e.g. Python; Recommended: thin films growth by pulsed laser deposition and/or sputtering, scanning probe microscopy, X-ray spectroscopies

Salary: 2889-3321 € gross monthly with benefits, based on experience (offer is for 1 year, renewable)

Start date: January 2024, with some flexibility

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