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Competition between ferromagnetism, Rashba spin-orbit coupling and superconductivity in an oxide 2DES

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Thanks to their tunability, oxide two dimensional systems (2DES) are an ideal test bench for the study of the coexistence among multiple ground states.

Recent experimental works carried out on LAO/STO based nanostructures, bring to light signatures of unconventional superconductivity thanks to the interplay with Rashba spin-orbit coupling [1]. These results are of interest for the investigation of novel quantum phenomena in oxide electronics.

The large and electric field tunable Rashba spin-orbit coupling shown by the LAO/STO 2DES is also of interest for possible spintronic applications [2]. A viable route for electric field control of the spin transport in novel spintronic oxide devices requires the creation of a spin polarized current. Recently, a spin polarized oxide 2DES has been designed and realized using a thin layer of delta doping $EuTiO_3$ (ETO) intercalated between LAO and STO [3]. X-rays magnetic circular dichroism and transport measurements indicate tunable ferromagnetic properties, in addition to superconductivity and Rashba spin-orbit coupling. We will present a study of the interplay between ferromagnetism and Rashba spin-orbit coupling in LAO/ETO/STO heterostructures performed by analyzing the quantum corrections to the magnetoconductance data as a function of the carrier density and of the temperature [4] and discuss possible implications for oxide spintronics.

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