Title: Two-dimensional oxides Platform for SPIN-orbitronics nanotechnology (TOP-SPIN)

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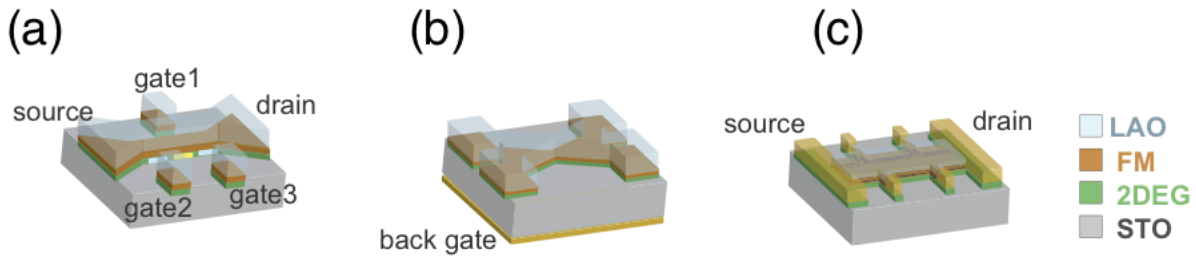
Other partners: Università Federico II di Napoli, Università di Cagliari, Università di Cosenza

The steady dimensional downscaling of components poses new challenges in microelectronics. Two-dimensional (2D) systems, characterized by radically new properties and functionalities, are emerging as the material choice for the next stage of Spintronics and Quantum Electronics revolution.
Among 2D-systems, 2D electron gases (2DEGs) formed at the interface between insulating transition metal oxides, like $LaAlO_3$ and $SrTiO_3$, are characterized by a unique combination of high-mobility, strong spin-orbit coupling (SOC), superconductivity, interfacial 2D-magnetism, and theoretically predicted topological states.
The target of our project is to understand how the interplay between Rashba spin orbit coupling, 2D-magnetism and 2D-superconductivity can be employed to design topological states and topological superconductors based on transition metal oxides. The final goal is the realization of electric field effect devices, based on the gate-voltage control of the functional properties of atomically engineered oxide-2DEGs..
Success in these endeavors will open the road towards a novel oxide electronics and will establish 2D-oxide materials as an important platform for spintronics and quantum electronics.



Some of the field effect devices that will be ralized within the project TOP-SPIN: a) side-gate field effect device based on spin polarized LAO/FM/STO 2DEG. Gate 1 control the properties, and, in particular the SOC, the carrier density and, eventually, the magnetism of the central part, wile Gate2 and Gate3 can be used to create local sin-polarized contacts. (b) Back-gate LAO/FM/STO Josepshon junction, with a nanostriction (Dajem bridge) with size comparable with the superconducting coherence length. (c) Multi terminal back-gated field effect device for searching topological edge states through non local transport experiments.