

MAGIC⁺ WORKSHOP

Magnetism, Interactions and Complexity

Invited

Oxide 2-dimensional electron gases for spin-charge interconversion

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Oxide 2-dimensional electron gases (2DEGs) display a wide range of functionalities including Rashba spin-orbit coupling (SOC), which offers exciting opportunities for spintronics. In this talk, I will show that the 2DEG that forms at the interface of SrTiO₃ (STO) with LaAlO₃^[1] or reactive metals such as Al^[2,3] may be exploited to interconvert spin and charge currents with high efficiencies. By applying a gate voltage, we tune the position of the Fermi level in the complex multi-orbital structure of STO, which results in a strong variation of the conversion amplitude with sign changes^[4]. This can be related to the band structure through ARPES experiment and tight-binding calculations. I will present results from both spin-charge conversion where spins are injected by spin pumping in a FMR cavity and detected as a transverse voltage^[5], and from charge-spin conversion probed through the bilinear magnetoresistance (BMR) effect. Through a semi-classical model, the analysis of the BMR amplitude yields a very accurate estimate of the Rashba coefficient^[6]. In a second part, I will present gate-controlled, all-electrical spin current generation and detection in planar nanodevices free from ferromagnets and only based on a STO 2DEGs^[7].

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