Oxide spintronics

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Spintronics is a branch of electronics in which transport phenomena are dependent on the electron spin. Future spintronics devices will be built from elemental blocks allowing the electrical injection, propagation, manipulation and detection of spin-based information. Owing to their remarkable multi-functional and strongly correlated character, oxide materials already provide building blocks for charge-based devices such as ferroelectric field effect transistors (FETs), as well as for spin-based two-terminal devices such as magnetic tunnel junctions.

In this lecture, I will first present results obtained on such oxide-based tunnel junctions using half-metallic electrodes of e.g. manganese perovskites. Then, I will discuss the spin-filtering effect by which highly spin-polarized currents can be generated through tunneling across a thin ferromagnetic or ferrimagnetic insulator (EuO, $BiMnO_3$, spinel ferrites), useable to obtain tunnel magnetoresistance. In a second part, I will review how non-magnetic oxide heterostructures can be designed to generate and detect spin currents through the direct and inverse spin Hall effect and the direct and inverse Rashba-Edelstein effects, in particular using oxide 2DEGs.

References:

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