Spin- and Angle-resolved photoemission studies on (100) Surfaces of Magnetite and $La_{0.7}Sr_{0.3}MnO_3$

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Spintronics is a fast-developing field, which is based on the manipulation of the spin degree of freedom. Successful application of spin-based devices requires a thorough clarification of the spin polarization transport and injection in solids. The next scientific frontier is to investigate magnetic materials in real time ultrafast dynamics on an atomic scale. Therefore, one needs to combine femtosecond optical and x-ray pulses in pump–probe experiments, where the evolution of a system is determined as a function of the delay between optical pump and x-ray probe pulse.

Here we present, as a first step before dynamics studies, Spin- and Angle- resolved photoemission (SARPES) experiments on two potentially spintronic suitable materials.

Recently, the interest was renewed in magnetite (Fe_3O_4) because of its high Curie temperature. This ferrimagnet has been theoretically predicted to be a half-metallic material with a conductive minority-spin channel and a semiconducting majority-spin channel, resulting in 100 % spin polarisation at Fermi level (E_F) [1]. But the situation remains unclear on the experimental side. In order to improve the bulk sensitivity of ARPES, we used laser-based SARPES on *ex situ* prepared Fe_3O_4(100)/MgO(100) thin layers. The laser photon energy (6 eV) is close to the photoemission threshold, so only a narrow region close to E_F can be measured. However, only the low-lying Fe t_{2g} *d*-bands (from E_F to about 1 eV below E_F) are of central interest.

Another half-metallic system is $La_{0.7}Sr_{0.3}MnO_3$. Our studies shed light on the influence of surface-perpendicular wavevector ($k_\perp$) broadening to the interpretation of electronic structure and especially to spin polarisation [2].

References:

[1] Z. Zhang and S. Satpathy, Phys. Rev. B **44**, 13319 (1991).
[2] J. Krempasky *et al.*, Phys. Rev. B **77,** 165120 (2008).