HOW TO ADDRESS RIDDLES IN SPINTRONICS ï PHOTOEMISSION SPECTROMICROSCOPY

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The field of magnetism has been developing at a rapid pace recently, driven by the advances in spin electronics. It is undisputed that the electronic structure is the origin of magnetism and thus also forms the basis of spin transport and dynamics. A precise knowledge of the electronic states and excitations is mandatory to understand the spin-based behavior of new materials and systems employed in spintronics experiments. The fast progress in spintronics, however, has brought about a wealth of novel materials and systems, often of complex chemical and magnetic nature. For most of these systems little is known about the electronic states and, in particular, its variation with deviations from the ideal chemical composition and ordering. Moreover, the electronic structure at interfaces and in nanostructures is becoming a quickly growing issue.

The experimental methods of choice to probe the details of the electronic structure are photoemission spectroscopies. In this contribution we will discuss several examples of the study of magnetic and spintronics material systems by means of different photoemission spectroscopy approaches. This will include spin-polarized photoemission investigations of the Fe(100)/MgO interface [1,2] and photoemission microscopy investigations of the oxidic heteromagnetic system Fe_3O_4/NiO [3,4] (fig.). We will also illustrate new developments in the area of photoemission spectroscopy, which address the issues of lateral resolution, interface selectivity [5], and depth sensitivity [6].

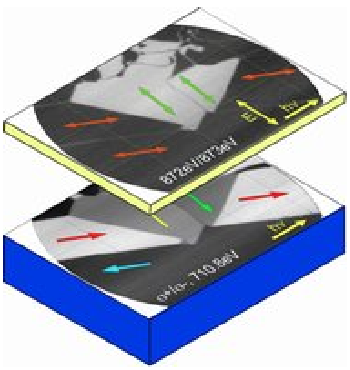

Figure: *Magnetic coupling in thin NiO films on Fe_3O_4(011) as imaged by x-ray photoemission microscopy. The arrows indicate the local mag netization direction in the ferri magnetic domains in Fe_3O_4 (bottom) ar the spin quantization axis in the anti-ferromagnetic domains in NiO (top).*

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