Looking deeper into magnetic oxides with hard x-rays

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Spintronics aims at introducing the electron spin as the carrier of information for future nanoelectronic devices. In this context, we explore magnetic oxides (MO) - either combined with Silicon or in all-Oxide heterostructures – with the ultimate goal to understand and develop their spin functionality in novel oxide spintronic hybrids.
We succeeded in mastering a highly reactive magnetic oxide-semiconductor model system: Europium Oxide (EuO) on Silicon. Our approach involves a successive optimization of the EuO/Si crystal structure, magnetic properties and interface chemistry. By applying hard x-ray photoemission spectroscopy (HAXPES) with an information depth of several nanometers, we unravelled both the bulk EuO and the EuO/Si interface electronic structure with high resolution and depth sensitivity. This is key to provide an atomically and chemically well-defined MO/Si heterostructure.
Moving towards spinfunctionality in an all-oxide approach, we investigated the magnetic dichoism (MCD) in single-crystalline EuO/YSZ(001), which showed a large MCD asymmetry in the deep Eu core levels and valence bands in high-energy photoemission (HAXMCD). The HAXMCD asymmetry is directly correlated with the EuO magnetic response, and gives new insights into the localized 4f oxide magnetism in this ultrathin Heisenberg ferromagnet.