

# Exploring functional properties at the nanoscale by X-ray photoemission electron microscopy

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X-ray photoemission electron microscopy (XPEEM) has emerged as a powerful analytical technique at the forefront of nanoscale surface characterization. XPEEM combines the capabilities of high-resolution electron imaging with X-ray spectroscopy such as X-ray absorption spectroscopy (XAS) and X-ray photoemission spectroscopy (XPS), enabling researchers to study the chemical composition, electronic structure, magnetic state and morphological details of surfaces with exceptional spatial resolution. In this talk, the key principles and instrumentation of XPEEM will be explained, and exemplary applications will illustrate the individual possibilities and limitations of the method. Special emphasis will be placed on element-specific magnetic imaging, a particular opportunity at a soft-ray beamline with full polarization control. Techniques such as X-ray magnetic circular dichroism (XMCD) and X-ray magnetic linear dichroism (XMLD), XPEEM offer the unique ability to image magnetic domains and their behavior with nanoscale precision. This capability is invaluable for the study of magnetic materials, including thin films, nanoparticles and magnetic heterostructures. Examples will be used to demonstrate the study of magnetic domains and the switching of magnetic structure using ultrashort laser pulses. These phenomena are important for the development of magnetic materials for applications in information storage, spintronics and beyond.