

Condensed Matter Studies with Polarized X-Ray

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One of the distinctive properties of synchrotron radiation is its ability to provide a high degree of well-defined polarization. By exploiting this characteristic, experiments can be designed to investigate various aspects of condensed matter—from magnetic and electronic to crystallographic properties—with both chemical and spatial sensitivity. In particular, the lecture will illustrate the use of polarization-dependent X-ray absorption spectroscopy (XAS), a technique capable of providing element-specific information on the electronic structure, orbital occupancy, and magnetic properties of complex systems, with particular emphasis on ferromagnetic and ferroelectric materials. X-ray magnetic circular dichroism (XMCD) and X-ray linear dichroism (XLD) will also be discussed in combination with X-ray microscopy, highlighting their ability to correlate local chemical and electronic properties with magnetic and ferroelectric domains at the nanoscale. Examples from current research will demonstrate how polarized X-ray techniques based on synchrotron radiation can reveal the interplay between structure, charge, orbital order, magnetism, and ferroelectricity. Overall, the lecture aims to show how polarized X-ray methods provide a versatile framework for understanding and controlling functional materials.