ABSTRACT:

X-ray Absorption and Dichroism as Unconventional Probes for Electronic Properties

X-ray absorption spectroscopy (XAS) and X-ray magnetic circular dichroism (XMCD) are widely used to investigate the electronic and magnetic properties of low-dimensional systems. Owing to their element selectivity and sensitivity to the unoccupied electronic states, these techniques have become key tools for studying the magnetism of individual atoms, clusters, and ultrathin films on surfaces.
In this talk, I will illustrate how XMCD can also provide information that goes well beyond its traditional use as a magnetic probe. In particular, the strong sensitivity of XMCD spectra to the local electronic configuration and atomic coordination makes it possible to detect subtle changes in the environment of individual atoms on surfaces.
Using the example of dilute chromium adatoms deposited on the Au(111) surface, I will show how the evolution of the XMCD spectral line shape with time reflects the transformation of isolated atoms into small aggregates. By quantitatively analyzing these spectral changes and combining them with statistical modeling, it becomes possible to determine the rate of atomic motion on the surface.
This example demonstrates how a spectroscopic technique primarily developed for magnetism can be used to probe atomic-scale processes such as surface diffusion. More broadly, it highlights the potential of X-ray absorption and dichroism as unconventional probes of microscopic dynamics and electronic properties in low-dimensional systems.