Enhancement of an Ultra-high Energy Resolution, Momentum- and Polarization-resolved Resonant Inelastic X-ray Scattering (RIXS) Facility at the APS

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Abstract

Condensed matter physics and materials science are driven by the need to understand materials' properties, with the ultimate goal of harnessing them in practical devices. Without exception, these behaviors are dominated by electrons, their degrees of freedom and their interactions. Resonant Inelastic X-ray Scattering (RIXS) has emerged as a very powerful synchrotron technique to measure electronic excitation spectra, thereby providing important insights into the dynamic response of a material, and illuminating such phenomena as High-Tc superconductivity, quantum spin liquids, and many others. We propose to enhance the existing RIXS beamline 27-ID at the APS with a new RIXS spectrometer, equipped with ultra-high resolution optics based on novel flat-crystal assemblies in conjunction with a collimating Montel mirror, as well as conventional optics using spherical crystal analyzers. This new spectrometer will offer unprecedented energy resolutions in the single-meV range and will include efficient polarization analysis, an important aspect which has thus far been mostly ignored due to technical difficulties. We further proposed to augment conventional RIXS instrumentation by novel spherical analyzers and meaningful in-situ sample environments.