Polarization modulation spectroscopy

Electronic Matter: Inhomogeneity, tunability, and discovery at extreme conditions

A scientific case for utilizing MBA lattice beams for search and discovery of novel electronic states of matter using hard x-ray magnetic spectroscopy at APS

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Abstract

Electronic inhomogeneity is a hallmark of correlated electron systems with competing interactions. These inhomogeneous quantum states underlie some of the most exciting phenomena of current interest in condensed matter physics including nematic charge/spin stripe order as a possible mediator of high Tc superconductivity in Copper-oxide "cuprates", and spin liquids where bond directional anisotropy or geometrical frustration leads to complex magnetic textures. We leverage two key properties of APS-U, namely, brilliant x-ray beams and round insertion device vacuum chambers to study mesoscale electronic/magnetic inhomogeneity in condensed matter physics and to tune/control these states with extreme high-pressures (Mbar range). A novel scheme for fast polarization switching (both linear and circular) using dual superconducting undulators coupled with ~100 nm beams results in x500 polarized flux gains and enables x-ray probes of electronic matter at extreme conditions to enter a new era of search and discovery.

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