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Polarization-dependent MAD holography: Nanoscale Magnetic Imaging of Nonperiodic Objects TIANHAN WANG, Department of Materials Science and Engineering, Stanford University, DILING ZHU, BENNY WU, Department of Applied Physics, Stanford University, OLAV HELLWIG, San Jose Research Center, Hitachi Global Storage Technologies, JOACHIM STOHR , Linac Coherent Light Source, SLAC, ANDREAS SCHERZ, Stanford Institute for Materials and Energy Sciences — We present a novel approach to the nanoscale imaging of nonperiodic magnetic structures by introducing x-ray polarization dependence to the multiple wavelength anomalous diffraction (MAD) phasing technique. Essential phase information can be extracted from the differences between coherent scattering patterns recorded at different x-ray wavelengths (on- or off-resonance) and polarizations. Combined with an iterative phase retrieval algorithm, the magnetization distribution can be reconstructed. Using left and right circularly polarized x-rays near the Co L3 edge, we successfully imaged the perpendicular magnetic worm domains of a Co/Pd multilayer sample within a 3 micron circular aperture. The absence of reference apertures and a resolution that is, in principle, only limited by the wavelength render this method attractive for polarization-dependent and element-specific studies in magnetism, correlated materials and polymer research. This research is supported by the U.S. Department of Energy, Office of Basic Energy Science.

Tianhan Wang
Stanford University

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