

Imaging Magnetic Nanostructures Using Soft X-Rays

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Two variants of photon-based soft x-ray microscopy using zone plate lenses (scanning and imaging) offer complementary and possibly unique capabilities to non-destructively image magnetic nanostructures compared to other magnetic imaging techniques. These capabilities include good spatial resolution (20-30 nm), element-specificity and penetrating power to study interactions between magnetic layers, field-dependent imaging capabilities, and direct quantitative sensitivity to vector magnetization. Studies using existing x-ray microscopes at LBNL's Advanced Light Source are looking at magnetic interactions between coupled magnetic layers, remnant and field-dependent magnetization in MRAM elements, vector magnetization in demagnetized films, and domain structures in films with perpendicular anisotropy. Microscopes and techniques will be reviewed, along with results from one or more of these studies. Growing experience points to limitations of existing microscopes and the need for a photon-based soft x-ray microscope dedicated to magnetic imaging.

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