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Advanced Photon Source

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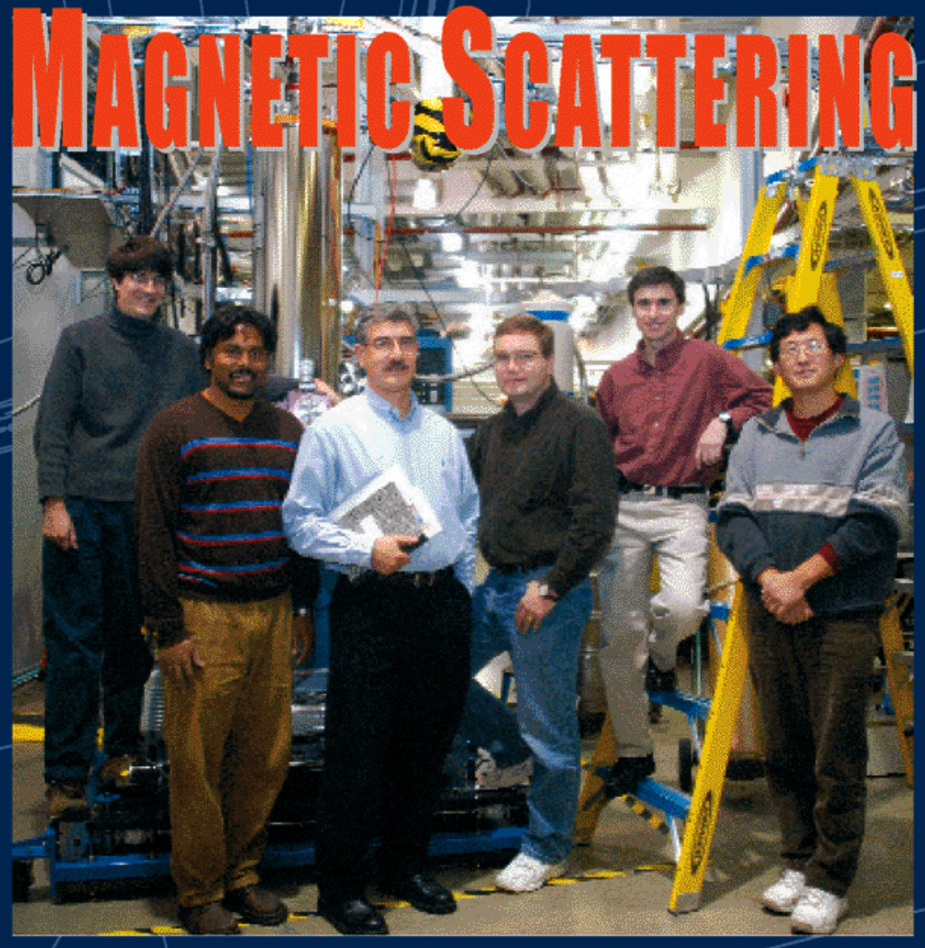
Research

Magnetic Scattering at the Advanced Photon Source

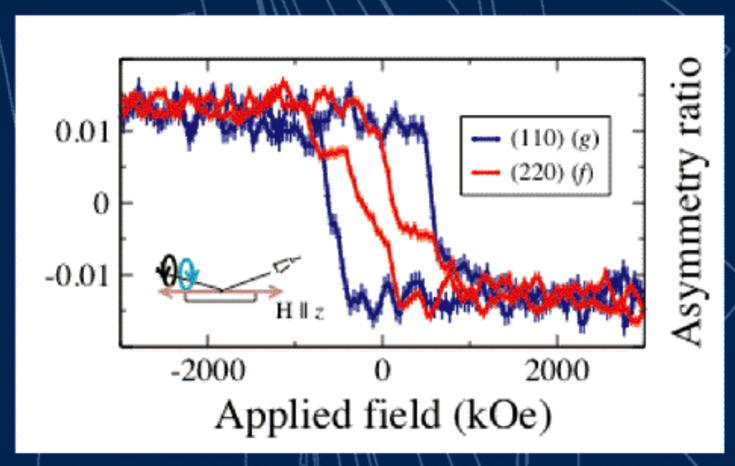


< L. to r.: X-ray Operations and Research personnel John Freeland, Zahir Islam, George Srajer, Jonathan Lang, Daniel Haskel, and Yang Ren.

Magnetic x-ray scattering is a powerful tool for studies of magnetic materials on a par with more established neutron scattering probes. The high brilliance of third-generation sources (high flux and collimation) such as the Advanced Photon Source (APS) compensates for the typically smaller cross sections of x-ray magnetic scattering and allows precise determination of magnetic modulations through highly defined scattering vectors. In addition, manipulation of the polarization of incident and scattered radiation, as well as energy tunability, allows the separation of spin- and orbital components of magnetization, and yields element specificity in heterogeneous materials. In the example below the x-rays' energy, scattering vector, and polarization were tuned to yield element- and site-specific magnetism in ferromagnetic $Nd_2Fe_{14}B$, a superb permanent magnetic material. Magnetic scattering experiments at the APS are routinely performed at sectors 4 and 6, and occasionally at sector 11.

A unique set of experiments merging diffraction and spectroscopic techniques, and using the circularly polarized x-ray beams from X-ray Operations and Research beamline 4-ID-D at the Advaned Photon Source, succeeded in separating the magnetic contributions of two types of rare-earth neodymium ions in dissimilar atomic environments. This separation, not possible with other techniques, led to the discovery that only one of the two types of neodymium ions enhances the magnetic stability of the best-performing magnet to date. The other type, surprisingly, reduces the magnetic stability, providing important new clues into how to manipulate the local atomic structure for future optimization of permanent magnets.

*See: D. Haskel, J.C. Lang, Z. Islam, A. Cady, G. Srajer, M. van Veenendaal, and P.C. Canfield, Phys. Rev. Lett. **95**(21), 217207 (2005).*



Element- and site-specific Nd magnetic moment reversal loops measured through dichroic resonant scattering of circularly polarized x-rays at (110) and (220) Bragg reflections.

Fifth International Conference on Synchrotron Radiation in Materials Science

July 30-August 6, 2006 · Chicago, Illinois

The Fifth International Conference on Synchrotron Radiation in Materials Science (SRMS-5) is the next in a series of international conferences, held every two years, bringing together leading-edge synchrotron x-ray researchers in the materials sciences. The goal of these conferences is to provide an overview of the latest research developments in a broad range of materials areas including biomaterials and polymers, electronic and photonic materials, engineering materials, nanostructures, surfaces and interfaces, as well as other topics such as instrumentation and novel techniques. For more information, see http://www.aps.anl.gov/srms5.html.

Call for Proposals

**At the Advanced Photon Source, our door is open to experimenters from all scientific disciplines whose research requires the highest brilliance hard x-ray beams in the Western Hemisphere.
General-user proposals for beam time during Run 2006-2 are due by March 10, 2006.
Information on access to beam time at the APS is at http://www.aps.anl.gov/user/beamtime/get_beam.html or contact Dr. Dennis Mills, DMM@aps.anl.gov, 630/252-5680.**

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