

View Abstract

CONTROL ID: 4562827

PRESENTER: Ian Robinson

AUTHOR PREFERRED PRESENTATION TYPE: Invited Speaker

SYMPOSIUM: CH02: Ultrafast Probes and Time-Resolved Techniques for Visualizing Materials Dynamics

ABSTRACT

TITLE: Ultrafast Coherent X-Ray Diffraction of Magnetic Domain Dynamics

AUTHORS (FIRST NAME, LAST NAME): [Ian Robinson](#)¹

INSTITUTIONS (ALL): 1. London Centre for Nanotechnology, University College London, NEW MILFORD, NJ, United States.

ABSTRACT BODY:

Abstract Body: The magnetic response of materials has a profound influence on their transport properties and relevant magnetic device applications whose speed can be a limitation. Below 240K, Mott insulator Sr_2IrO_4 forms an ordered antiferromagnetic (AFM) state where the spins are locally aligned in opposite directions with zero net magnetic moment. In crystals, this results in a lower symmetry described by a supercell structure, leading to additional unique magnetic Bragg peaks in diffraction. We studied the (106) magnetic Bragg peak of Sr_2IrO_4 at 100K with laser pump-probe time-resolved resonant coherent magnetic X-ray diffraction imaging, to measure the migration velocity of its antiferromagnetic domain walls using an X-ray Free Electron Laser (XFEL). During the laser-induced demagnetization, we observe X-ray images of micron-sized clusters of magnetic phase domains which reconfigure within 100 fs following excitation by an optical laser, with their boundaries moving at 3×10^6 m/s. This is closer to a typical Fermi velocity, than the speed of sound, implying an electronic mechanism. The return relaxation is slower, taking longer than 10 ps, suggesting that lattice coupling may be involved. We also show that domains regrow in the same location every time. Fundamentally, this behavior is understood to arise from a purely electronic spin contribution to the magnetic structure without any role for coupling to the crystal lattice.

I. K. Robinson, D. Yang, R. Harder, D. Sheyfer, L. Wu, J. Griffiths, E. Bozin, M. P. M. Dean, J. Liu, H. Zhao, G. Cao, A. Rodriguez-Fernandez, J-E. Pudell, Ro. Shayduk, J. Wrigley, A. Zozulya, R. Rysov, A. Leonau, U. Boesenberg, J. Hallmann and A. Madsen, Spatio-temporal migration of antiferromagnetic domain walls in Sr_2IrO_4 , under review (2026)

KEYWORDS: Properties/Magnetic/magnetic properties, Performance/Functionality/quantum effects, Composition & Microstructure/Bulk Techniques/x-ray diffraction (XRD).

© 2025 Silverchair. All Rights Reserved. | © ScholarOne, Inc., 2026. All Rights Reserved.
ScholarOne and Abstract Central are registered trademarks of ScholarOne, Inc.

[Sign up to receive updates](#) |  [System Requirements](#) |  [Privacy Statement](#) |  [Terms of Use](#) | [Accessibility](#)

Product version number 4.17.4 (Build 383). Build date Mon May 11 08:52:15 EDT 2026. Server ip-10-236-27-252