Heterogeneous material dynamics encoded with coherent X-rays

Yue Cao

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3:00 p.m.
Bldg. 402 | APS Auditorium

The advent of diffraction-limited X-ray sources ushers in an era of materials research in which coherent photons can be used to encode heterogeneities and dynamics in a wide range of quantum and functional materials. For realistic materials and devices, such dynamics often cover decades of length and time scales. Exploring the vast spatiotemporal parameter space to obtain insights into materials requires novel experimental and analysis approaches. In this talk we present our recent progress harnessing the power of X-ray imaging tools – scanning nano diffraction, X-ray photon correlation spectroscopy and dark field X-ray microscopy. Examples include the heterogeneous distribution and evolution of nanoscale domains in materials from relaxor ferroelectrics to van der Waals materials. We outline opportunities and challenges from the extremely brilliant coherent X-ray sources, such as the upgraded APS, and discuss what these mean for the next generation of light sources.

Dr. Yue Cao is a physicist in the Materials Science Division at the Argonne National Laboratory. His research focuses on the emergent properties in a wide range of quantum and functional materials using cutting-edge X-ray methods. His recent interest lies in developing coherent and ultrafast X-ray approaches for understanding the material responses under the external electric and optical stimuli.

Dr. Cao obtained his B.S. from Tsinghua University in China in 2007 and his Ph.D. from the University of Colorado at Boulder in 2014. He was a postdoctoral research associate at Brookhaven National Laboratory before joining Argonne as a staff scientist. Dr. Cao was awarded the Early Career Award from the U.S. Department of Energy (DOE) in 2023 and served as a member of the User Executive Committee of the Linac Coherent Light Source between 2020-2023.

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