WORKSHOP # 9 - Thursday, April 23, 2026

Characterizing Amorphous Materials: Seeing Order in Disorder

Organizers: Sooyeon Hwang (CFN, BNL), Judith Yang (CFN, BNL)

Amorphous and disordered materials are central to many DOE-relevant technologies, including electrochemical energy storage, catalysis, functional oxides and chalcogenides, radiation-tolerant materials, and nanoscale thin films. In these systems, properties are governed by short- and medium-range order, chemical and topological heterogeneity, and dynamic structural rearrangements that are not accessible through conventional crystallographic methods. Quantitatively linking local structure to functionality therefore remains a fundamental challenge.

This symposium focuses on advanced multimodal and correlative characterization approaches for amorphous materials, including nanobeam and fluctuation electron diffraction, 4D-STEM, electron and X-ray pair distribution function analysis, coherent scattering, and spectroscopy. Emphasis is placed on in situ and operando measurements that capture structural and chemical evolution under realistic stimuli such as temperature, electric fields, chemical environments, and irradiation. Speakers will also highlight data-driven and computational analysis methods, including statistical, inverse, and machine-learning approaches, that enable extraction of meaningful structural descriptors from complex, high-dimensional datasets. Together, these efforts showcase how integrated CFN and broader BNL capabilities advance understanding of disorder-driven structure–property relationships.

Start Time (ET)	Title	Speaker (Affiliation)
9:00-9:10	Welcome	Sooyeon Hwang/Judith Yang (BNL)
9:10-9:50	Keynote: Electron Correlation Microscopy: Nanoscale Dynamics of Supercooled Liquids from Time-Resolved, Coherent Electron Scattering	Paul Volyes (University of Wisconsin–Madison)
9:50-10:20	4D-STEM of Disordered Materials: Probing Nanostructure to Understand Properties and Dynamics	Jinwoo Hwang (The Ohio State University)
10:20-10:45	Order and Disorder in Amorphous Energy Storage Materials through Transmission Electron Microscopy	Hyeongjun Koh (Brookhaven National Laboratory)
10:45-11:00	*Break*	
11:00-11:30	Deep Learning Model for Obtaining Spatially Resolved Pair Distribution Functions from 4DSTEM Data	Colin Ophus (Stanford University)
11:30 - 12:00 pm	Quantification of Amorphicity in Ultrathin Metal Oxide Films by X-ray Absorption Spectroscopy and Electron Microscopy	Mingzhao Liu (Brookhaven National Laboratory/ Stony Brook University)
After 12:00 pm		Lunch provided by the meeting office