MONASH University

Monash Centre for Electron Microscopy

Seminar

New Dimensions in Scanning Transmission Electron Microscopy

Tuesday May 14, 2024

11.00am – 12:00pm

Lecture Theatre S9
16 Rainforest Walk (Bldg 25)
Monash Clayton Campus

Colin Ophus

Abstract

Scanning transmission electron microscopy (STEM) has become an essential tool for materials science research, where it has been applied to atomic-scale imaging, diffraction, spectroscopy, and 3D tomography of many materials. Recent STEM development has been driven by hardware aberration correction, better holders and microscope optics, direct electron detectors, and rise of computational imaging and powerful data science methods. In this seminar, I will show how advanced detectors and computational methods enable 4D-STEM studies which improve signal-to-noise, resolution, and statistical power of STEM measurements. Examples shown will include structural characterization of metallic alloys, complex ferroelectric oxides, 2D heterostructures, weakly-scattering soft matter samples, and materials for energy applications. I will demonstrate results of atomic electron tomography (AET) experiments, where the 3D position and species of every atom can be identified in nanoscale samples. I will emphasize the important role of developing open-source algorithms, codes, and simulation methods to promote robustness, reusability, and repeatability for scientific studies. I will also show how modern deep learning methods can remove one of the ultimate limits of STEM experiments, by inverting measurements in the presence of strong multiple scattering of the electron beam.

Biography

Colin Ophus is a staff scientist at the National Center for Electron Microscopy (NCEM), part of the Molecular Foundry, at Lawrence Berkeley Lab in Berkeley, California, USA. His research group focuses on experimental methods, reconstruction algorithms, and software codes for simulation, analysis, and instrument design of transmission electron microscopy (TEM) and scanning TEM (STEM). He also runs a user program primarily focused on data analysis for STEM, supporting dozens of microscopy researchers from around the world. He has published over 190 peer reviewed articles, given over 80 invited talks, and taught dozens of workshops around the world. In 2018 he received a DOE Early Career award, and in 2022 he was awarded the Burton medal from the Microscopy Society of America (MSA). He has also received awards for top papers in the field of microscopy from the MSA in 2019 and 2021, and the Molecular Foundry Outstanding Staff Service Award in 2020. He is project leader for the open-source Prismatic STEM simulation and py4DSTEM analysis codes. He is always excited to talk to other scientists and students and can be reached at cophus@gmail.com.

Convener: Professor Laure Bourgeois
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Visitors are most welcome. Monash University Clayton campus map can be found at: http://www.monash.edu.au/pubs/maps/3-Claytoncolour.pdf. Please note the parking arrangements. There is a designated Visitors Car Park (N1) clearly ground-marked by white paint. Payment for parking is made using the CelloPark app.