

# Seminar

## New capabilities in energy-loss spectroscopy in the scanning transmission electron microscope

 Friday 12 July, 2019	<b>Prof. Christian Dwyer, Arizona State University</b>
 11.00am	
 Lecture Theatre S12 16 Rainforest Walk, Monash Clayton Campus	

**Abstract:**

The recent development of coupled monochromator-spectrometer systems in the scanning transmission electron microscope (STEM) enable an energy resolution better than 10 meV. This enables a new capability to perform electron energy-loss spectroscopy (EELS) in the visible and infrared portions of the spectrum. The small electron beams that can be generated in the STEM provide intrinsically high spatial resolution, so that it becomes possible to perform nanometer-scale vibrational analysis of free standing materials in a transmission geometry. Combined with the other imaging modes available in the STEM, these new capabilities provide an extremely powerful “toolkit” for nanomaterials analysis.

In this talk I will report on several new avenues which are under development, including (1) nanometer-resolution vibrational mapping of materials, whereby an off-axis collection geometry avoids the inherent delocalization associated with sub-eV inelastic electron scattering; (2) an EELS analog of surface-enhanced Raman spectroscopy, whereby field enhancement from nanoparticle surface plasmons provides an amplification of chemical adsorbate vibrational signals; and (3) electron-beam mapping of point defect centers in semiconductors, whereby the improved energy resolution in EELS may enable detection and mapping of individual point defects.

**The Presenter:**

Christian Dwyer is an electron microscopist with backgrounds in scattering and condensed-matter physics. He received his Ph.D. from the University of Cambridge in 2004.

From 2004-2007 he was a postdoc in the Department of Materials at the University of Oxford, and then from 2007-2012 was a research fellow in the Department of Materials Engineering at Monash University, Australia.

From 2013-2015 he worked as a staff scientist at the Forschungszentrum Juelich, Germany. Since 2015 he is an associate professor in the Department of Physics at Arizona State University.

**Convenor:** Professor Joanne Etheridge

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