MONASH University

Monash Centre for Electron Microscopy

Seminar

Atomic scale exploration of the vibrational and plasmonic response of nanomaterials in the electron microscope

Wednesday September 9, 2020

5.00pm (AEST)

ZOOM

https://monash.zoom.us/j/91705435727?pwd=d0tNb0grQzlhbXl1SE1KYWVEUVVOZz09

Dr Fredrik S. Hage

Fredrik Hage is a Staff Scientist at the SuperSTEM Laboratory, and Senior Research Fellow at the University of Oxford.

Abstract

Advanced electron source monochromation in the electron microscope allows for accessing the collective mode response in electron energy loss spectra of materials, down to THz frequencies. This technical achievement has, since 2014, resulted in nanoscale exploration of the vibrational response of a wide range of materials systems. In this context, we developed and demonstrated a methodology for mapping and interpreting the dispersion of collective vibrational modes or phonons in solids. A key aspect of this work was maintaining nanometre spatial resolution, thus effectively probing volumes ~10^{10} to 10^{20} times smaller than that of comparable techniques. Beyond the nanoscale, we recently demonstrated that atomically resolved vibrational electron energy loss spectroscopy is possible in the electron microscope. We did this using a so-called dark field experimental geometry. This approach lends itself to the exploration of the vibrational signature of individual defects, as we have shown for the case of a single tri-valent substitutional silicon atom in single layer graphene. Beyond vibrational spectroscopy, we have investigated atomic scale effects induced by single boron and nitrogen dopant atoms on the collective valence electron or plasmonic and extreme-UV optical response of graphene.

The Presenter

Fredrik received his PhD in Physics from the University of Oslo (Norway) in 2013 for work focused on electron energy loss spectroscopy of carbon nanocones, holding a PhD Research Fellowship from the Institute for Energy Technology (Norway). The same year he joined the SuperSTEM Laboratory and University of Glasgow as a Staff Scientist. In 2018 he became Senior Research Scientist at SuperSTEM and the University of Oxford, and in 2019 Senior Research Fellow. The SuperSTEM Laboratory is the EPSRC National Research Facility for Advanced Electron Microscopy, a user facility located on the SciTech Daresbury Science and Innovation Campus, just outside Warrington in the U.K.

Convener

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