

The development of atom-wide monochromatic electron beams in transmission electron microscopes has enabled the realization of phonon spectroscopy studies in nanomaterials with superb spatial resolution. This is permitting us to unveil new phonon properties of advanced materials with potential applications in infrared nanophotonics, nanoscale heat transfer, and quantum technologies. In this seminar, we will describe progress along those directions by highlighting results involving (i) imaging and spectroscopy of hyperbolic phonon polaritons in twisted low-symmetry crystals, (ii) studies of heat transfer across nanoscale gaps, and (iii) localized phonon behaviour across semiconductor interfaces. These results represent progress towards understanding the role of phonons in physical process involving light-matter interaction and nanoscale energy transfer.