

SEMINAR

Friday, 18.7.2025, 11:00, Kolar's Lecture Hall

Visualizing Atomic Vibrations: A New Frontier in Electron Microscopy

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Recent groundbreaking developments in aberration-corrected scanning transmission electron microscopy (STEM) combined with advanced vibrational electron energy-loss spectroscopy (EELS) techniques have fundamentally transformed the way atomic-scale lattice dynamics and phonon behaviors are studied. In this seminar, I will highlight our seminal work in developing and applying state-of-the-art, spatially and momentum-resolved vibrational EELS methodologies to directly visualize phonon modes at atomic resolution. Our approach enables the unprecedented observation of localized phonon phenomena at individual defects, interfaces, and nanostructures, profoundly advancing our understanding of phonon-defect interactions, thermal boundary conductance, and electron-phonon coupling in materials.

I will present key examples from our recent studies, including the direct imaging of defect-localized vibrational modes, nanoscale mapping of interfacial phonons, and quantification of phonon momentum distributions in quantum dots and phonon-electron coupling at superconducting interfaces. These insights provide critical foundations for addressing fundamental challenges in thermal management, quantum materials engineering, and solid-state ionic devices. Ultimately, our innovations offer powerful tools to elucidate and engineer the atomic-scale behaviors that dictate the performance of next-generation functional materials and systems.

Kindly invited.