



# Seminar

## Lensing free electrons at the nano and atomic scale



Friday, February 2, 2024



11.00 am

### SCIENCE LECTURE THEATRE S1

16 Rainforest Walk (Building 25)

Monash Clayton Campus



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### Abstract

Transmission electron microscopy (TEM) is a primary scientific instrument to examine condensed matter at the nano and atomic scale. The latest generation of TEM has achieved a spatial resolution better than 0.5 Å. This allows for the imaging and spectroscopy of individual atoms, detecting charge transfers between bonded atoms, and even imaging single-atom magnetization. Despite continuous improvements in TEM resolution, the fundamental architecture of the TEM has remained unchanged since its invention in 1931. High energy electrons are primarily focused using magnetic lenses, and the focal length of the magnetic lens is typically in the millimeter range due to the limited, finite flux density in magnetic lenses.

In this presentation, I will demonstrate the modulation of high-energy electrons using the intrinsic electric field of matter and lensing electrons at the nano and atomic scale. In addition, I will also present some achievements in the development of electron imaging and spectroscopy techniques, including new phase retrieval algorithms for electron holography, quantitative electric field mapping with 4D and quantitative STEM; 3D confocal imaging with coherent electrons, and a few examples of electron energy loss spectroscopy (EELS) to study the physical properties of semiconductor and oxide materials. I will also discuss potential secondary and backscattering electron imaging applications in TEM.

**Convener:** Professor Joanne Etheridge

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### Biography

Changlin Zheng is a professor in the Department of Physics and State Key Laboratory of Surface Physics at Fudan University in China. He received his Bachelor's and Master's degrees from Nanjing University and obtained his Ph.D. degree in physics from Humboldt University of Berlin, Germany. From 2010 to 2017, he worked as a research fellow at the Monash Centre for Electron Microscopy, Monash University. In late 2017, he joined Fudan University as a professor of Physics. His research interests focus on developing advanced TEM techniques and applying them to the field of condensed matter physics.