Faculty of Engineering
Summer Research Program 2021-2022

Project Title: **Revealing crystal secrets, picometre by picometre....**

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**Objective**

*To uncover crystal secrets by developing new ways to ‘image’ atoms and the electrons that bond them together.*

**Project Details**

*Picture this:* an electron probe, much smaller than an atom, is stepped across a crystal at picometre intervals. At each picometre step, a diffraction pattern is recorded, providing a million bytes of information about the specimen. This is a modern scanning transmission electron microscope experiment and it delivers terabytes of information about atomic-scale volumes of a specimen. *How can we extract this information to learn about the atomic and electronic structure of a material?*

In this project, we will explore how to exploit this wealth of new information to reveal crystal structures and their defects (for example, [1]). We will develop new ways to interrogate diffraction patterns taken using the world-first “Spectra Phi” Transmission Electron Microscope (just being installed in MCEM) so that we can extract information about each of the atoms that makes up a crystal structure.

Depending on your interests, this can involve the development of mathematical descriptions of electron scattering or computer coding or applying existing computer code to simulate experiments. The project can be adapted accordingly.


**Prerequisites**

None but you will have more fun if you have an interest in using electrons to investigate the world around you.