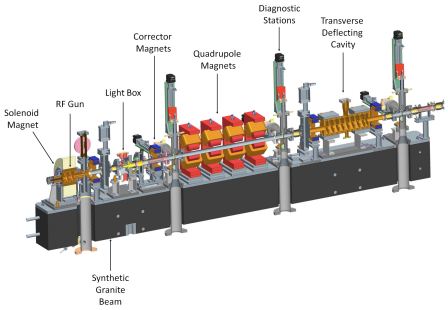
PhD Position: Computational Discovery and Optimisation of Novel Photocathodes for Free Electron Lasers

Supervisor: Nicholas M Harrison

Much of what we know about the atomistic and microstructure of matter comes from observations made in third generation light sources (synchrotrons) which provide bright beams of coherent radiation that is tunable from near infra-red light to hard X-rays. This has enabled the measurement of structure, composition, electron and magnetic structures of ever more complex systems that is essential to developing an understanding of molecular level mechanisms.



Fourth generation sources will be based on the free electron laser. The injection of bunches of electrons into a linear array of magnetic undulators and wigglers produces pulses of coherent, near monochromatic light with very high intensity. The time resolution allows for measurements of the evolution of systems on a femtosecond time scale and the prospect of unpicking the **dynamical mechanisms** operating in, for example, biology, chemistry and physics.

One of the constraints on the performance of FELs is the sensitivity to the details of the electron bunches at insertion. These are generated from photocathodes using the photoelectric effect to emit a pulse of electrons from a surface exposed to a well defined burst of light from a laboratory laser. These photocathodes operate for long periods of time under laser illumination and so have a potentially very rich surface structure and chemistry.

In this project you will join a well-established international collaboration that is making, characterising and modelling the performance of advanced photocathode materials. The project will involve developing theoretical and computational techniques for predicting the photoemission spectra from heterogeneous surfaces with engineered coatings in order to establish the design rules for photocathodes with high quantum efficiency and low emissivity.

The project is based within the computational materials science group at Imperial College London and will involve close collaboration with the accelerator science teams at STFC in the UK and the Advanced Light Source at Berkely Lab. in the USA.

https://www.stfc.ac.uk

https://als.lbl.gov

Application process

This project is associated with the CDT in the Advanced Characterisation of Materials and so your applications should be submitted via:

https://cdt-acm.org/phd-opportunities-2021/application-process/

We welcome applications from candidates for the Autumn 2021 entry. Ideally, you will hold, or be expected to achieve, a Master's degree or a 4 year undergraduate degree at 2:1 level (or above) in a relevant subject, e.g. Material Science, Physics, Chemistry or Chemical Engineering.

Further information

For further information please contact Professor Nicholas Harrison, nicholas.harrison@imperial.ac.uk

Funding

The funding covers the stipend and fees at Home-student rate as well as a research budget for consumables and travelling to conferences for a 4 year period. The UK government will decide in due course if EU students with settled or pre-settled status are eligible for the home-student fees. You can still apply if you do not fall under these categories but you may need to find additional support for the difference in fees.