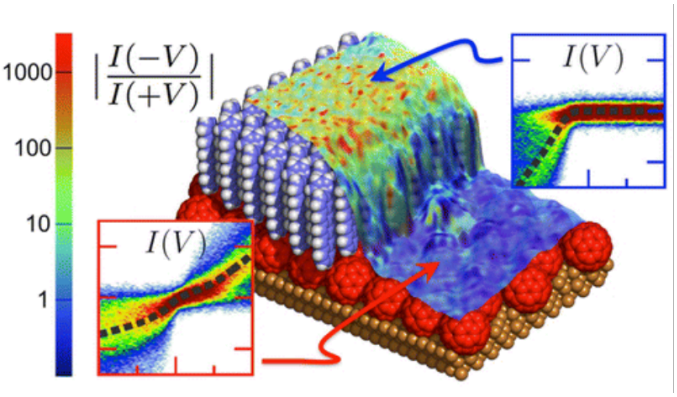
UCLan JHI PhD Scholarships 2020/21

The scholarship includes a maintenance grant of £15009 p/a, bench fees and tuition fees to UK level. International students will have to pay the difference between UK fees and international fees, which is about £10500 p/a.

Project 1: This PhD project involves pursuing a promising research route to understanding the structure and function of molecular electronics devices on the smallest scales. The fundamental building block of electronics is the p-n junction, or diode.

Our research group has recently constructed the highest performing molecular-scale diodes ever observed.



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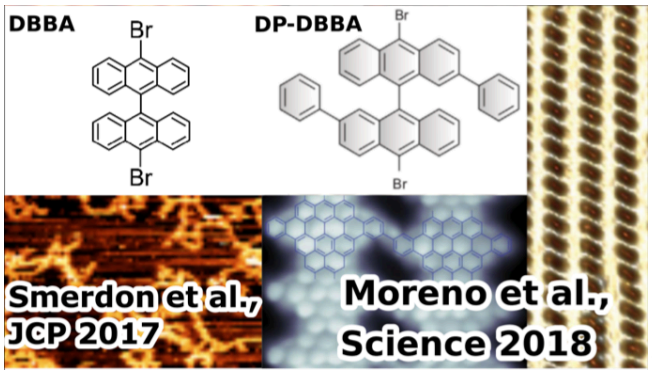
Moore's law states that computer power doubles every eighteen months. The main technological improvement behind this is miniaturisation. The current process constructs circuits with minimum feature size around 12 nm. This is very impressive, but we can't get much smaller because in 12 nm, there are only about 100 atoms. So the ultimate granularity of matter is soon going to impact on our ability to miniaturise.

This is because all of our electronics rely on properties of 'bulk' material. These properties change drastically when we start trying to build things with single atoms.

We need to find a so-called bottom-up way to construct circuits, using the properties of molecules (which are inherently semiconducting) to replicate the properties of our old silicon semiconductors. This area of study is called molecular electronics.



Project 2: We propose to exploit several recent developments to demonstrate true atomic-scale engineering of carbon.

Graphene has been the subject of some large promises over the last fifteen years, but the most successful application area are slight improvements on competing technologies, e.g. carbon fibre composites, or metal oxide transparent conductors.

The interesting thing about graphene is it is a 2d material, made out of carbon, which is also the backbone material of all of the complex molecules of biology. This both shows us what can be made, in terms of complexity, and gives us a clue about how to make it.

We will connect together custom-designed and fabricated molecules, using an ideal surface to give us a 2d template. In this way we will create new materials with tailored properties.

Keywords: UHV, scanning tunneling microscopy, fullerenes, molecules, graphene