

## **PhD Studentship - UCL EPSRC DTP Award**



### **PhD Studentship “Entanglement and New Quantum Phenomena in Semiconductor Nanostructures”**

Applications are invited for a fully funded EPSRC DTP PhD Studentship to work with Professor Sir Michael Pepper and colleagues in the London Centre for Nanotechnology on a project utilising advanced semiconductor nanostructures for the discovery and exploitation of Entanglement and other new Quantum effects.

The studentship will cover Home tuition fees and an annual stipend of no less than £17,609 increasing annually with inflation. The studentship is funded for 4 years on a full-time basis and will start in October 2022.

#### **Studentship Details**

The project will develop and extend our recent experimental discovery that electron-electron repulsion can break a single row of confined carriers into two or more separate rows, this is the start of a Wigner Lattice in which the mutual repulsion of the electrons determines how they organise in space. The separate lines of the zig-zag are entangled and give rise a new fractional conductance, which comprises novel, highly interacting, fractional state. This phenomenon is the long sought non-magnetic equivalent of the Fractional Quantum Hall Effect. Theory has established that the fractions arise due to the entanglement of two rows of electrons which can be manipulated by varying their mutual separation. The new fractions will be studied as a function of electric and magnetic fields which alter the wavefunctions, in particular the formation of the fractional state in quantum dots of differing geometries will be explored and a read-out mechanism established.

Electron focussing in which a current is injected into a 2D region and then focused by a magnetic field allows an imaging of the ground state wave function which changes as electrons strongly interact. We have recently shown that this method allows observation of the transition from single to double rows and it will be a valuable diagnostic tool for the formation of the Wigner lattice. The technique can also be used to determine the spin polarisation of the separate rows of the lattice.

The physics of the process will be explored and a Quantum Computation scheme developed based around the entanglement of the electrons as the Wigner Lattice forms. The experiments will use the group’s very low temperature facilities and will involve device fabrication in the LCN Clean Room and collaboration with theorists in the UK and abroad.

#### **Eligibility**

Suitable candidates for this post will have a first or upper second class honours undergraduate degree and/or a post-graduate masters qualification in Physics or Engineering. Applicants must meet the EPSRC conditions that to be eligible for the award there are no restrictions on their right to live in the UK permanently and have 3 years residency before the start of their course.

#### **Applications**

Interested candidates should submit a supporting statement, a full CV (including contact details for at least two academic referees) and a copy of transcripts to-date via the [PhD Portal](#).

The supporting statement should clearly state the name of the project you are applying for at the top, and outline your interest in and suitability for, researching the suggested topic. On the application form, you do not need to complete the “Layman Summary” question, please just indicate the name of the project in this

section instead. Referees will be contracted separately, so you do not need to supply references at the point of application. You will need to tick the box on the PhD Portal application form indicating this. Successful candidates will be invited to submit a formal application to UCL.

The closing date for applications is 17 June 2022. The project will commence in October 2022. Any further information about the studentship should be directed to Professor Sir Michael Pepper, [michael.pepper@ucl.ac.uk](mailto:michael.pepper@ucl.ac.uk)