Quantum physics and technologies of germanium low-dimensional structures

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Strained germanium low-dimensional structures, with unique high hole mobility and very low effective mass, are emerging as versatile materials to realize devices capable of encoding, processing and transmitting quantum information and therefor leading to invention of disruptive quantum technologies. These structures rely on unique properties of holes, caused by quantum effects in the superior quality strained epitaxial germanium, such as their inherently strong spin–orbit coupling and their ability to host superconducting pairing correlations.

This experimental PhD project is an exciting opportunity to be involved in innovative and pioneering research on quantum physics and technologies of strained germanium materials and low-dimensional structures. The project is based on pioneering work at Warwick University, led to invention of high mobility 2D holes in strained epitaxial germanium heterostructures. The experimental information will add greatly to knowledge of materials science, quantum physics and technologies; and is expected to enable novel quantum devices architectures. Epitaxial growth for this research will be carried out at Warwick University, using unique to UK academia, epitaxial growth equipment upgraded beyond state of the art. Characterisation of grown materials and fabricated quantum devices will be carried out in-house using a range of sate of the art equipment and techniques and in collaboration with existing academic and industrial partners. This exciting research, at the cutting edge of quantum physics and technologies, will involve very close collaboration with scientists from international universities and research centres. Successful outcome from the project would lead to high impact publications in international scientific journals and creation of intellectual property with enormous impact potential.

The successful PhD candidate is expected to have outstanding track record, with demonstrable strong background in science and technology of semiconductor materials and devices. The skills and experience learned throughout the PhD will make the candidate an expert in quantum physics and technologies, materials characterisation and quantum devices fabrication. These skills can be transferred across the semiconductor and broader condensed matter fields.