

Fully funded PhD positions:

Microwave Quantum Technology with trapped electrons

The Sussex Centre for Quantum Technologies is focused on fundamental quantum science as well as on the development of novel quantum technologies. It covers an extensive research area, such as quantum computation and communications, microwave quantum sensors, theoretical quantum optics, quantum metrology and others. Sussex offers a unique environment for highly motivated PhD candidates, providing advanced training in a wide variety of experimental and theoretical skills.

The research group of Dr J. Verdu is focused on the use of trapped electrons for quantum technology. Several PhD positions are currently available in the area of Quantum Metrology and Sensing, namely on the use of quantum microwave radiation for the detection, measurement and scanning of objects: from large devices to biologic samples, single virus particles, materials and others. The PhD projects will focus on demonstrating experimentally, for the first time, the “Quantum Illumination” protocol in the microwave domain [1,2]. “Quantum Illumination” has been proposed and theoretically demonstrated as a revolutionary quantum metrology technique, potentially capable of overcoming the accuracy limitations of current MW measurement instruments. It works by probing the objects with entangled microwave photons [2], however, a practical implementation of the quantum illumination technique is still an open experimental challenge. At Sussex we have developed a pioneering ion trap technology, which uses a single trapped electron as the quantum emitter and receiver of the microwave radiation [3]. This will allow for the efficient and practical realisation of the “quantum illumination” protocol. The future real-world applications of our research are Near-Field Scanning Microwave Microscopy, Quantum Radar and Quantum Microwave Imaging.

The PhD candidates will work with an existing experimental ion trap setup at the University of Sussex, www.geoniumchip.org. The successful candidates will receive training in ion trap technology, magnetic fields design with superconductors, cryogenics, RF electronics, MW engineering and quantum optics. The students will also have the chance present their work at international conferences. The project involves international collaboration with world-class quantum optics theorists, as well as with industry leaders.

References:

- [1] Seth Lloyd, “Quantum Illumination,” *Science*, **321**, 1463 (2008).
- [2] Shabir Barzanjeh *et al*, “Microwave Quantum Illumination,” *Physical Review Letters*, **114**, 080507 (2015).
- [3] April Cridland *et al*, “Single microwave photon detection with a trapped electron,” *Photonics* **3**, 59 (20016)

Funding Notes/ Eligibility

Applicants should preferably have (or expect to achieve) a First or Upper Second Class Masters degree in Physics, or a related subject.

The position is for 4 years, fully funded (fees and stipend) for UK/EU students. The project is funded by the Defence Science and Technology Laboratory (DSTL) and is also strongly financially supported by Leonardo MW Ltd.

Timetable

Candidates are encouraged to apply, or at least make an expression of interest, as early as possible. The positions will be filled as soon as suitable candidates are found.

Further information

This is a full-time studentship and the successful candidate will be able to devote their whole time to research. The group's webpages can be found at: www.sussex.ac.uk/scqt/ and www.geoniumchip.org

Contact Dr Jose Verdu: j.l.verdu-galiana@sussex.ac.uk

How to apply

Please go to our webpage: www.sussex.ac.uk/study/phd/apply

You should enter the name of the project you wish to apply for in the finance section.