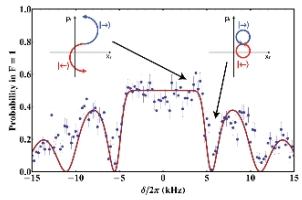
University of Sussex

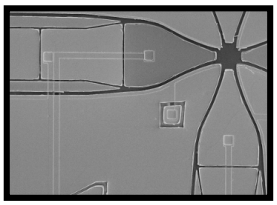
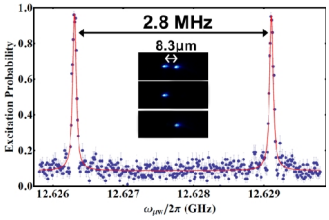
PhD positions in quantum technologies with trapped ions: Microwave quantum logic, quantum simulation, ion microchips and quantum sensing

A number of 3.5 year PhD positions are available in the Ion Quantum Technology Group in the Department of Physics & Astronomy at the University of Sussex. The positions consists of current UK/EU fees, a yearly stipend of £ £14,057 which can be supplemented by tutoring. The positions includes a yearly travel allowance. You should have a physics or related degree. The positions are part of the UK Quantum Technology Hub on Networked Quantum Information Technologies and the UK Quantum Technology Hub for Sensors and Metrology.

Application deadline: Please apply preferentially by 26 May 2015. A second round of applications may be considered until 26 June, 2015 for an additional position.

Research in novel quantum technologies will likely lead to step changing innovations which will affect many areas of modern sciences. Implementing such technologies with trapped ions quantum bits has been widely accepted as one of the most promising pathways. The aim of this studentship is to develop a microwave ion trap quantum computer and quantum simulator.



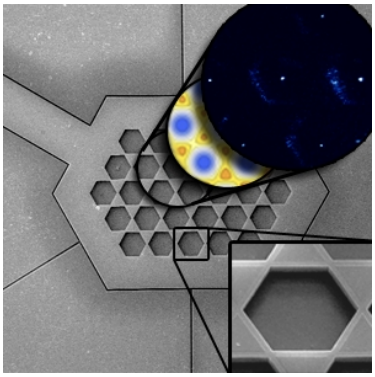



Quantum gates with trapped ions may be classed in two different categories, namely gates involving optical radiation and gates that utilize microwave radiation. In order to build a large scale ion trap quantum computer, it is critical to develop entanglement methods that are easily scalable to a large number of quantum bits. Large-scale quantum computers may require in excess of millions of individual quantum bits. It is quite obvious that creating the required number of laser beams to entangle the ions may indeed entail significant engineering and come at a significant cost. By contrast, the use of microwave radiation for the same purpose would be much easier and would make the construction of an actual large-scale ion-trap quantum-information processor much simpler. At Sussex, we are developing both a new generation of ion chips and coherent manipulation methods to develop fault-tolerant quantum gates with microwave radiation. Outcomes of your PhD project may be an entirely new fault-tolerant quantum gate for trapped ions, the theoretical foundation and experimental demonstration of various quantum algorithms, and the efficient implementation of quantum simulation, ion microchips and a portable quantum sensor. You may also participate in the construction of a fully scalable ion-trap quantum computer demonstrator device.

You will learn all the experimental skills and theoretical background needed in this emerging field of science. Some of the skills you will acquire include nano-fabrication, lasers and optics, ultra-high vacuum techniques, quantum information science, electronics and many other skills.

The city of Brighton & Hove has everything - sun, sea, brilliant clubs, great places to eat, fabulous shops, a truly cosmopolitan vibe and is located only 50min from central London. Located on the beach, Brighton boasts beautiful seaside views and beaches, boating, sports and beach activities. The South Downs provide breathtaking views, tranquil walks and plenty of opportunities for mountain biking, hiking or picnics.

You can find out more about the group here (including a BBC documentary about our research group):
http://www.sussex.ac.uk/physics/iqt/
The 'Research' section of the website features specific information for prospective PhD students. You can also take a virtual lab tour.



Detailled reading about some of our research directions can be found here (full text available here: http://www.sussex.ac.uk/physics/iqt/publications.html):

- Generation of spin-motion entanglement in a trapped ion using long-wavelength radiation, K. Lake, S. Weidt, J. Randall, E. Standing, S. C. Webster, W. K. Hensinger, Phys. Rev. A 91, 012319 (2015)
- Microwave ion-trap quantum computing,
  Winfried K. Hensinger, Nature 476, 155 (2011)
- Fabrication and operation of a two-dimensional ion-trap lattice on a high-voltage microchip, R. C. Sterling, H. Rattanasonti, S. Weidt, K. Lake, P. Srinivasan, S. C. Webster, M. Kraft & W. K. Hensinger, Nature Communications 5:3637 (2014)

For more information, please email the head of group,
Prof Winfried Hensinger, (Professor of Quantum Technologies) (w.k.hensinger@sussex.ac.uk).

To apply please email a CV, and your degree results **preferentially before 26/5/2015 or the latest by 26/6/2015** to the email address above. Note in order to qualify for these positions you must have resided in the UK or Europe for three years prior to the start of the position. If you are from outside Europe, you may apply for a non-funded position in the group, however, you will need to have a funding source for tuition fees and living expenses.