Experimental quantum communications at any scale

Thu, 2020-11-19 10:23 - Georgia Mortzou [1] **At:** Department of Physics, University of York
Deadline: 31 January, 2021

Location

Department of Physics, University of York York YO10 5DD United Kingdom
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Quantum communications are revolutionising the way we transmit information and connect remote parties. Leveraging on the quantum properties of photons and on the tools developed for optical communications, it is now possible to create a quantum network that distributes confidential information to distant users with the highest level of security and creates strong quantum correlations – or entanglement - at its nodes, thus shaping the future quantum internet.

This emerging technology is at the base of the so-called ‘second quantum revolution’, which aims to exploit quantum mechanics to develop new products and services for the society. It is at the same time capable of engaging industry and attracting substantial funding from governments worldwide. The U.K., in particular, is playing a leading role in the second quantum revolution and has invested on quantum technologies since 2013 through the UK National Quantum Technologies Programme.

Quantum communications can be established at any scale, from a few metres, as in a quantum ATM machine, to hundreds of kilometres in an optical fibre network, or even thousands of kilometres in a satellite link. Each range presents its specific challenges and requires ad-hoc solutions. Coherently connecting quantum communications at different scales is also an elusive target for which there is not, to date, an effective solution.

As part of a major expansion in experimental research and development at the York Centre for Quantum Technologies, three funded PhD studentships have been made available. In the three projects presented here, you will work to solve the specific challenges of each quantum communications segment and to make the solutions available at different scales. The key enabling technology will be a quantum repeater, which can replicate a quantum signal from one station to the next without altering its quantum content. The first effective quantum repeater came into existence in 2018 under the name of ‘Twin-Field Quantum Key Distribution’ (TF-QKD) and it has already been used to considerably extend the transmission range of QKD and its tolerance to lost photons.

In these new projects, you will perform experimental research on TF-QKD so to better understand its counter-intuitive properties, enhance its performance and facilitate its future deployment in real quantum networks. Both optical fibres and free space are propagation media of interest to the projects. As in other forms of quantum repeaters, you will establish and utilise sources of single and entangled photons and you will investigate the quantum properties of light that are useful to implement real quantum communications. This research will be carried out using different types of light detectors: single-photon detectors, which are typically used in the so-called ‘discrete-variable’ QKD, and coherent detectors (homodyne and heterodyne), which are employed in ‘continuous-variable’ (CV) QKD. CV-QKD is a major expertise in the University of York and is supported both experimentally and theoretically by world-renowned scientists. The successful applicant will work on state-of-the-art CV-QKD systems and on the related enabling technologies.

We are seeking PhD candidates with suitable undergraduate training in physics, engineering or related subjects who are keen to research in quantum optics and its applications to communications. The three funded studentships are available now, so successful applicants already holding an appropriate undergraduate degree could start prior to September 2021.

For informal enquiry please contact Prof. Marco Lucamarini (marco [dot] lucamarini [at] york [dot] ac [dot] uk">marco [dot] lucamarini [at] york [dot] ac [dot] uk).

Funding Notes

The advertised positions are already funded. Successful applicants already holding a suitable undergraduate degree could start any time prior to September 2021.
Full studentships are available to UK, EU and non-EU students who have been ordinarily resident in the UK for at least three years. Partial studentships are available for EU nationals that reside in the EU, EEA or Switzerland.
The applicants should be willing to spend most of their time in the lab. However an inclination for theory or simulations will be positively considered during the interview.
This position will be based primarily at the University of York

For more information and to apply, please visit https://www.findaphd.com/phds/project/experimental-quantum-communications-at-any-scale/?p125365

- PhD [3]

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