



Quantum-Secure Communications

Secure communications

The security of data sent, received and stored has become increasingly important in the world of networks that we all rely on for professional, business and personal purposes - e.g. in finance and healthcare. Quantum physics offers a way of ensuring the security of data communications that has far-reaching benefits across the public and private sectors, including the UK's critical infrastructure. Development and use of products, processes and services based on the required technology will contribute to the growth and future expansion of multi-billion pound quantum industries for the UK.

Standard methods for securing data communicated over networks involve the sharing of 'keys' that are used in the encryption and de-encryption of the data. These methods currently rely on mathematical complexity to protect the security of the keys themselves. However, quantum physics provides an alternative to mathematical assumption as the underlying foundation for security.

This is Quantum Key Distribution (QKD) which encodes keys using properties of photons. A critical consequence of such use is that eavesdropping on the key distribution channel leaves a detectable trace that can be used to ensure that subsequent transmissions of data are secured, even against attacks using other quantum technologies.

Where are we now?

Quantum data may be transmitted in the form of light over a fibre-optic cable network, directly through the air, and potentially between satellites. Developing the technology for reliably transmitting quantum-secured information is also important for the longer-term goal of building quantum computers and the vastly superior processing power they will provide.

The next steps towards the commercialisation and affordability of QKD involve systems engineering, the design of architectures, prototypes, and demonstrators.

The UK National Quantum Technologies Programme aims to ensure the successful transition of quantum technologies from laboratory to industry. The programme is delivered by EPSRC, Innovate UK, BIS, NPL, GCHQ and Dstl.



The Quantum Communications Hub

The Quantum Communications Hub, part of the UK National Quantum Technologies Programme, is a collaboration of university and industrial partners brought together to accelerate development of the technology from research. The Hub partnership is working in a number of areas to provide prototypes and accessible technology demonstrators. These include:

- the UK's first quantum networks - long-haul (between the cities of Bristol and Cambridge in the first instance); metro (to R&D labs and industry clusters sites within Bristol and Cambridge initially); and access (specific connection points to networked QKD for testing and early adopters - fig 1);
- chip-scale integration of QKD modules – for use in a range of devices and systems (fig. 2);
- short-range QKD - secure communication between low-cost personal devices and services (e.g. access to ATMs; fig 3).

The Hub will provide access to these demonstrators to support exploitation and adoption by and for industry. The Hub is also central to international efforts to define formal QKD standards, which are critical to commercial exploitation.

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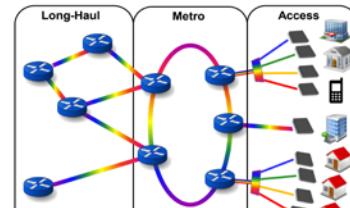


fig 1. Quantum networks

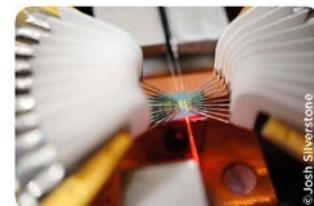


fig 2. Chip-scale integration



fig 3. Short-range QKD