Note of the Quantum Technologies Roundtable,

4th July 2013

Why act now?

This meeting between industry, researchers and government organisations highlighted the UK's competitive position and the willingness to work together in a national endeavour to translate scientific leadership into economic benefit. The disruptive nature of quantum technology means that existing businesses would not necessarily be able to adopt these technologies into their current business.

Recent rapid developments in quantum technologies, including the sales of the D-Wave Two quantum computer[1] and commercial quantum cryptography systems, have brought to the fore the potential disruption that harnessing quantum technologies could offer across a broad spectrum of applications and potential commercial growth as highlighted by the investments our competitors are making in this area – Switzerland, Canada and Singapore are making significant investments.

Quantum technologies offer the prospect of very disruptive impact and the ultimate improvements in precision, sensitivity, accuracy, speed and security that the laws of physics allow, in a range of areas, from secure communications, metrology, sensors, simulation, to information processing and computing. The UK has a strong position with regards to patents in areas such as quantum computing and quantum cryptography.

Why the UK?

The UK has played an international role leading the research base in quantum physics – now is the time to move beyond physics to seize the potential of quantum technologies for the UK. We have some unique and complementary centres of excellence each of which enjoys strong links to potential industrial or user organisations. The UK also has a strong position with regards to patents in this area.

At the meeting, Professor Ian Walmsley summarised the UK's strengths which can contribute to quantum information science and technology being turned into applications and industries. He laid out the reasons why the UK environment is highly conducive to this, stressing the strengths throughout the UK academic research landscape across the range of potential quantum technologies i.e. quantum computing, cryptography, sensing, metrology, imaging and quantum information processing. He also highlighted the areas which can contribute to advances in science being transformed into advances in technology and engineering, such as photonics, semiconductor optoelectronics, high frequency electronics, computer science and communications.

[1] D-Wave sells second quantum computer – this time to NASA (Physics World, July 2013)

Representatives from NPL, DSTL Nokia, Toshiba Research Europe and BAE Systems were all able to explain the threat or opportunity that their business saw from the rapid advances in quantum technology, an area that was progressing much faster than any of them had anticipated; the recent product launch of D-Wave Two system being one such example. Importantly, there was an immense breadth to potential impact of quantum technologies, ranging in their maturity levels.

Future workforce

Critical to the exploitation of quantum technologies, will be the supply of highly skilled people. This is an area that is really exciting young people with the demand from undergraduates of the highest quality to undertake PhDs far in excess of available opportunities. Increasingly business, if adopting quantum technologies will need quantum engineers who can simplify and enhance the robustness of quantum devices and systems. This is being recognised in Europe with this area being a priority for Horizon 2020. The UK can deliver these highly trained individuals through its world leading institutions in tertiary education.

Requirements to realise the promise

- expand this group and collaborate further to promote the opportunities for quantum technology;
- effort to build on and take advantage of the strengths in quantum science and technology that are distributed across the UK;
- focus on agreeing and addressing the key technological research challenges that need to be overcome to enable the development of effective quantum technologies, to ensure that the science is taken through to technology and engineering;
- exploit common ground with other research areas, which can support progress in the development of quantum technologies, and which the UK has strength;
- foster links with industry and other partners in order to build an understanding of the potential and of the capability needed, to deliver a platform of opportunities for the UK;
- the provision of state of the art equipment and facilities is essential to maintain and further develop UK research strengths in quantum technologies;
- exploit the high level of interest in quantum technologies, particularly through the supply and training of highly skilled individuals into this area;
- connect UK efforts in quantum technologies through information sharing and community building activities, in order to make this a national network.

Next Steps

By the end of September 2013 we will have explored the formation of a network of quantum technology centres which take account of the key points described above and will send the Minister a forward plan of action. The participants of this

round table discussion all agreed to be involved in these deliberations and to share quantum technology roadmaps where they are developing these.

Appendix: Attendance List

David Willetts, Minister for Universities and Science
Dr Lesley Thompson, Director EPSRC (chair)
Professor Jeremy O'Brien, University of Bristol
Professor Ian Walmsley, Oxford University
Prof Gerald Buller, Heriot Watt University
Dr John Morton, University College London
Professor Myungshik Kim, Imperial College
Dr Antti Niskanen, Nokia Research Centre
Dr Andrew Shields, Toshiba Research Europe
Dr Steven Harris, BAE Systems
Dr Neil Stansfield, Dstl
Dr Alastair Sinclair, NPL
Mr Ben James, IPO
Dr Nick Appleyard, TSB

Officials present
Sue Armfield, BIS
Tanya Gurung, BIS
Liam Blackwell, EPSRC
Zoe Brown, EPSRC
Amanda Howes, EPSRC