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Four UK hubs to make 'spooky' quantum physics useful

Universities of Birmingham, Glasgow, Oxford and York will lead efforts to develop applications from environmental sensing to secure communications.

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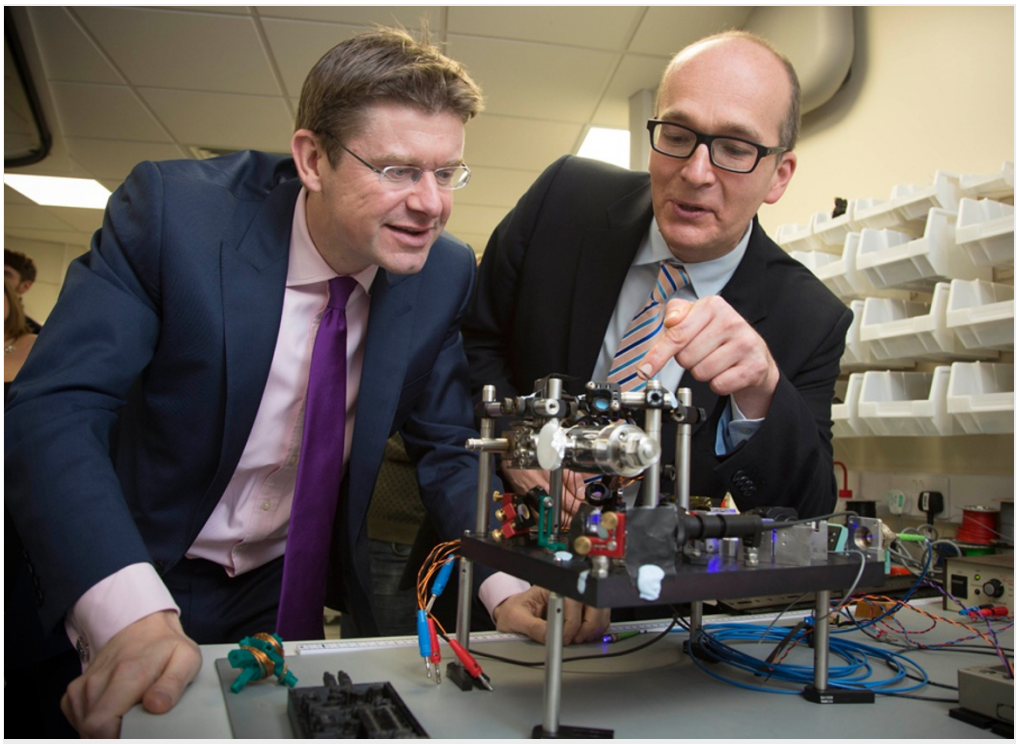

John James/University of Birmingham

Physicist Kai Bongs (right) of the University of Birmingham, UK, shows a gravity sensor to science minister Greg Clark, who has announced funding for a UK network of quantum technology hubs.

Ultra-precise atomic clocks and quantum computing are among the technologies getting a boost from the UK government. Four groups have been selected to share £120 million (US$188 million) to take their quantum research out of the lab and into industrial application.

The four winning hubs will be led by the universities of Birmingham, Glasgow, Oxford and York, but will also involve 13 other universities as well as 132 companies.

Physicists from the University of Birmingham cheered as Greg Clark, the UK Minister of State for Universities, Science and Cities, announced the decision at their university on 26 November. “You’ve got scientific excellence and some of our non-university institutions and companies all working together,” Clark told *Nature* shortly after the announcement. “It’s an exemplar of the way where science policy is going.”

The money is part of a £270-million pot set aside last December by Chancellor of the Exchequer George Osborne for the UK National Quantum Technologies Programme, which aims to boost innovation in the fields of health care, communications and security.

Over the next two years, the four quantum hubs will split the £120-million investment announced in Birmingham, plus another £35 million to fund fellowships, PhD programmes and and the transfer of ideas, skills and technologies out of the lab. The funds will be distributed through the Engineering and Physical Sciences Research Council (EPSRC), a government research-funding agency.

Over the past century, understanding the laws of quantum physics enabled engineers to build the transistor, the laser and other technologies that are now ubiquitous. That was the “Quantum 1.0 revolution”, says University of Birmingham physicist Kai Bongs. “Now we’re ready for the Quantum 2.0 revolution,” he says, which will exploit “more spooky features of quantum mechanics, such as superposition — an atom being in two places or different states at once. It allows us to use it to make very precise sensors for quantum

computers, secure communication and low-noise imaging."

Selection criteria

Out of 16 initial proposals, 8 made it on to a shortlist. The shortlisted proposals were first reviewed by an external panel of international experts and industry members, and then the applicants were invited to an interview in September. The process was "extremely competitive", says EPSRC spokesman Richard Tibenham. "Six proposals were considered to be of extremely high quality, and worthy of consideration for funding." But in the end, only four won.

Losing out are teams from Imperial College London, which is working on a quantum-based, ultra-precise positioning system for submarines, as well as groups from University College London and the universities of Bristol and Lancaster. (See 'Quantum-hub finalists picked'.)

Each of the winning hubs will focus on a different application. Oxford's will be quantum computers and quantum communications, "with devices that control matter at the atomic level", says University of Oxford physicist Ian Walmsley.

Glasgow's team will explore quantum sensing and imaging, aiming to develop new types of ultra-sensitive cameras that could be used in medical imaging as well as security and environmental monitoring. The cameras will be able to make gas leaks visible and see clearly through smoke or underneath the skin, says physicist Miles Padgett of the University of Glasgow.

The Birmingham hub will work on improving the accuracy of quantum measurements, developing "ultra-precise gravity sensors to detect sinkholes under roads and to search for oil and minerals, as well as a miniature clock for precision timekeeping in broadband communication networks and in financial trading," says Bongs. At the moment, he says, financial traders get precise timing from the Global Positioning System, which can be jammed or could fail if there was a big solar flare.

The hub at York, meanwhile, will focus on quantum encryption systems to improve the security of communications. "Quantum communication technologies have particular importance as these are very well developed already, with prototype technologies already in existence and ready to be developed further," says physicist Tim Spiller of the University of York.

"Historically, the follow-up and exploitation of world-class research has arguably been a UK weakness," he adds. "So it is very heartening to see that this is now being addressed."

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