

Press release: Spooky science at Dstl

Understanding the bizarre behaviour of quantum particles is challenging but offers many marvellous and mysterious uses that could benefit us all. At the Defence Science and Technology Laboratory (Dstl), physicists are focusing on quantum technology for navigation and sensing.

Working with experts from UK industry and academia, Dstl is developing deployable devices that will be used to see through walls, around corners and underground. For example, the gravity imager uses cold atom technology to detect minute changes in density caused by spaces such as tunnels or rooms, and create a ghostly picture of the hidden world. For the military, this can detect and map hidden areas, but it could also be used more widely to find, for example, sink holes and buried pipes.

Chris, a physicist in Dstl's Future Sensing Technology team, said:

Quantum-enhanced sensors can detect gravity changes at a very fine scale. We're working with industry and academia to shrink the size, weight and power of systems, moving from lab-based prototypes to deployable devices. Crucially, these devices retain the ability to perform measurements to a remarkable level of precision.

We're also developing mathematical tools to make use of the information that these sensors gather. In the case of the gravity imager, we can go from a collection of individual gravity observations to a three-dimensional image of what the subterranean world looks like.

Dstl has already helped Thales create a system that can see, image and identify multiple moving targets at range around corners using quantum photonic technology. The exquisite precision of the technology means it could, in theory, be used to diagnose medical disorders and detect density anomalies without any invasive procedures.

Quantum can also protect us against otherworldly phenomena. Space weather events can interfere with the global navigation satellite system (GNSS) – which includes GPS – and potentially wreak havoc on our daily lives. A recent government report estimates that five days without GNSS would cost the UK economy £5.2 billion. Quantum-based systems for position, navigation and timing would not be affected. Such systems would also be safe from intentional jamming and spoofing.

Chris added:

As well as the gravity imager, we're working on quantum clocks and accelerometers for ultra-precise timing and navigation. GNSS relies on a strong signal between satellites and receiver; whenever this

connection is lost or degraded, for example if you're inside a building or tunnel, the uncertainty in your position grows. Quantum sensors bypass this issue by taking local measurements of motion. The potential applications extend beyond military use; for example first responders could have a navigation system to help in a collapsed building.

At Dstl, we do a lot of our work with the National Physical Laboratory, Birmingham University and Imperial College ensuring UK defence and security benefits from this cutting-edge technology. Glasgow, Strathclyde, Oxford and many other universities are also working with us on future novel quantum sensing technologies.

Dstl has run three successful summer schools for PhD students researching quantum technology. The courses have given students an awareness of military applications and systems engineering, as well as commercial and business skills, to help them think about real-world uses of their research and empower them to contribute to the future UK quantum landscape after they have concluded their current research.

Watch the video to find out more about quantum physics.

[What is quantum physics?](#)