Faster detection of hidden objects by new terahertz sensor

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A new type of sensor, that is much faster than competing technologies used to detect and identify hidden objects, has been developed by scientists at the University of Warwick.

Called 'Q-Eye', the invention senses radiation across the spectrum between microwaves and infra-red, known as the Terahertz (THz) region of the spectrum – a goal that has challenged scientists for over 30 years. It works by detecting the rise in temperature produced when electromagnetic radiation emitted by an object is absorbed by the Q-Eye sensor, even down to the level of very small packets of quantum energy (a single photon).

The device could help address the weaknesses reported earlier this month in America's airport security, where mock weapons and explosives were smuggled through airports, undetected in 95% of cases. It may also prove useful in discovering concealed goods in the retail industry or for non-destructive monitoring, for example quality control in drugs or food. Other applications include astronomical and climate science observations and medical diagnosis.

Professors in Warwick's Nano-Silicon Group, Physics Department, Evan Parker and Terry Whall, led the team which developed the device. Professor Parker commented, "We were very surprised when our first very crude prototype showed such impressive speed and detection performance and our initial calculations indicated world-beating detector capability – all this and using silicon."

Made using standard silicon processes, large numbers of detector chips containing designs matched to a particular application can easily be fabricated on large (300mm) wafers with great uniformity, setting it apart from existing technologies.

The patented device involves a thin film of aluminum deposited on top of a silicon layer placed under strain, used to create an electronic cooling (e-cooling) process. The electrons in the silicon layer are so isolated from the silicon lattice they become highly sensitive to incoming radiation. This revolutionary e-cooling process is the secret to Q-Eye sensor's exceptional performance, enabling fast imaging and material identification.

Professors Parker and Whall are currently working on a demonstrator of the device, having been awarded a £100,000 Smart award from Innovate UK. The work is moving out of academic research into the commercial world, offering opportunities for partnership and investment. Companies involved in the personnel screening market have already expressed interest in the Q-Eye device.

Warwick Ventures, Warwick's technology transfer business, has helped the professors to create a spin-out company, Q-Eye Ltd, to develop and market the technology. Melody Stokes, Warwick Ventures Business Development Manager, and Phil O'Donovan, Warwick alumnus and a Cambridge based business angel, are working with the academics to build the commercial team, secure commercial partners and raise funding to develop the first commercial prototypes.

Melody Stokes adds: "We're delighted to have distinguished Warwick alumnus Phil O'Donovan advise the team. He brings invaluable experience of developing early-stage technology into scalable businesses. The global market for devices that operate in the THz region is growing at around 26% year on year, so Q-Eye is well placed to support the UK's

strategic lead in the sector. A longer term opportunity lies in quantum computing, set to revolutionize the way we handle and encrypt data."

Provided by University of Warwick