# New silicon chip for helping build quantum computers and securing our information

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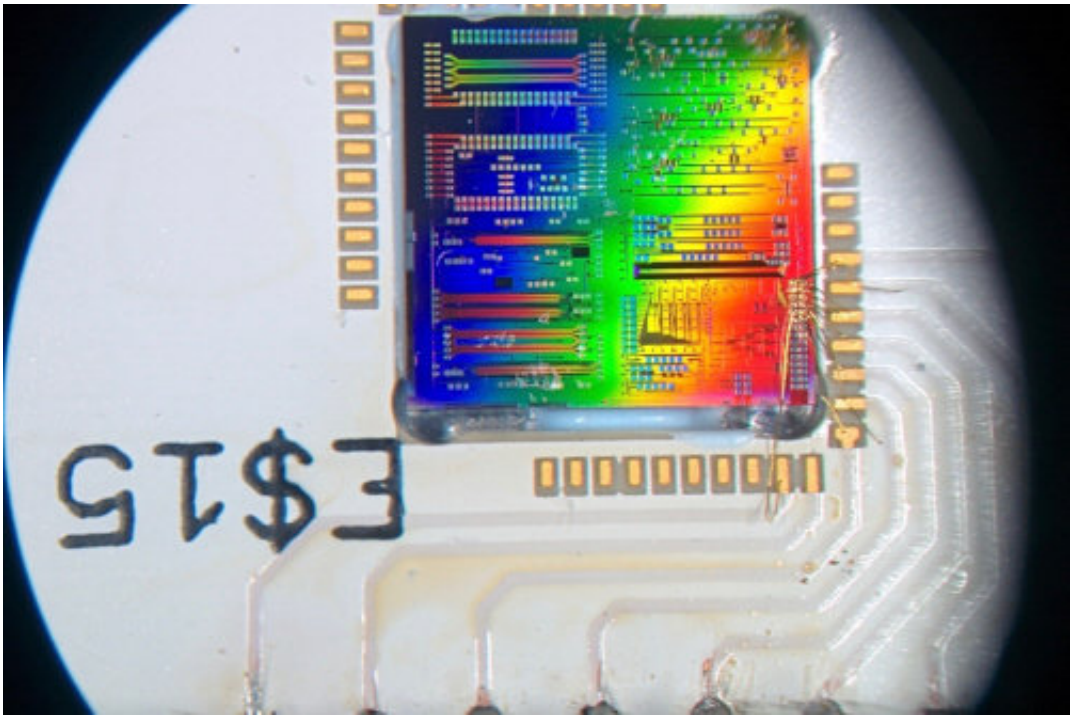

Microscope image of a silicon chip that contains tens of quantum optics experiments. The newly developed detector is tiny: it occupies less than 1 mm2 on the chip shown, in the bottom right. Credit: University of Bristol

Researchers at the University of Bristol's Quantum Engineering Technology Labs have demonstrated a new type of silicon chip that can help building and testing quantum computers and could find their way into your mobile phone to secure information.

Scientific effort worldwide is focused on attempting to use silicon photonics to realise quantum technologies, such as super-secure communications, quantum super computers and new ways build increased sensitivity sensors. Silicon photonic chips process information made of light using an area millions of times smaller than if you were to try make the equivalent device using individual lenses, mirrors and other optics.

Now, researchers at the University of Bristol have made a breakthrough for silicon quantum photonics—they have developed new type of on-chip detector capable of measuring quantum mechanical behavior within the integrated chip architecture. This is a new tool for making sure silicon photonic processors work the way they are designed and can themselves be used for other tasks, such as generating random numbers for cryptography, vital for the security industry, and as an important part of new types of optical sensor.

PhD student Giacomo Ferranti explained, "The great thing about the detector is that it works at room temperature. A lot of single photon detection requires cryogenics at ~4 Kelvin" (minus 270 degrees centigrade).

"While those cold detectors have their own amazing benefits, they are currently expensive and require large cryogenic fridges. Our detector is both small enough to sit on a human hair and can work in normal room temperature conditions."

One of the key applications that the detector has already been used for by the researchers is to generate random numbers.

"The ability to generate truly random numbers with a machine, without any bias, is actually a very difficult task" explains Francesco Raffaelli, another PhD student responsible for the project. "Random numbers have

all sorts of applications, but the one that interests me the most is its use for cryptography and quantum cryptography. One day soon, I imagine these devices will be routinely part of the micro-processor on your desktop PC and in your mobile phone to keep them secure."

**More information:** Francesco Raffaelli et al. A homodyne detector integrated onto a photonic chip for measuring quantum states and generating random numbers, *Quantum Science and Technology* (2017). DOI: 10.1088/2058-9565/aaa38f

Provided by University of Bristol