Researchers take a step towards quantum computing

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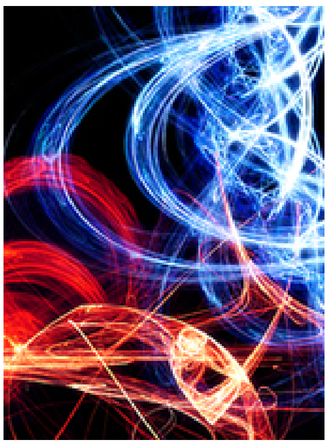

A team from Cardiff University's School of Physics and Astronomy fired light particles, or photons, into a tiny tower of semi-conducting material. A photon collides with an electron confined in an even smaller structure within the tower, and they oscillate briefly between the states of light and matter, before the photon re-emerges.

The Cardiff team have conducted this experiment with both individual and pairs of photons. They showed that photon pairs increase the frequency of the oscillation between light and matter over individual photons. Their findings agree with theoretical predictions first made in the 1960s.

The findings have long-term implications for information and communications technology. It may one day be possible to build logical systems based on the interactions of these particles - also known as quantum computing. As the particles move faster and use less energy than conventional electronic computer components, this would lead to more efficient processing.

However, the technical problems involved are still extremely difficult. The Cardiff team used a semiconductor tube of 1.8 micrometers in diameter. It was kept at a temperature of around -263ºC (ten degrees above absolute zero) and the photons were trapped inside a semiconductor tube only for around 10 picoseconds.

Professor Wolfgang Langbein, who led the team with Dr Jacek Kasprzak, now at Néel Institute, CNRS Grenoble, said: "This interaction can produce a steady stream of photons, and can also be the basis for single photon logic - which requires the minimum amount of energy to do logic. In the long term, there are implications in a number of areas, including computing, telecommunications and cryptography devices.

"To use this technology in real computing devices will take a significant improvement of the low-temperature properties and ideally its translation to room temperature. At the moment we have no clear concept how to do this - but it is not impossible."

The group's findings have just been published in *Nature Materials*. The world-class semiconducting structures used in the experiments were developed at the University of Würzburg in Germany.

Provided by Cardiff University