Coherent control of entanglement from two to multiple spatially separated physical systems of matter and light
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Quantum communication a step closer?

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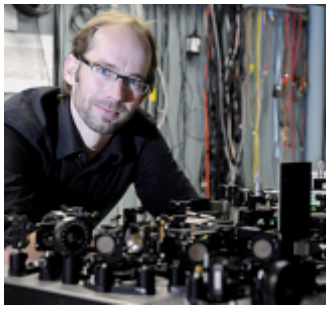
Researchers at the University of Calgary in Canada are working on a way to make quantum networks a reality and have published their findings in the journal Nature (www.nature.com) . According to Dr Wolfgang Tittel, pictured, who is leading the team, information coded in light has been successfully stored and retrieved from a crystal using a quantum physics phenomenon called entanglement.



"We have demonstrated, for the first time, that a crystal can store information encoded into, what's called in quantum mechanics, entangled quantum states of photons," said Dr Tittel of the university's Institute for Quantum Information Science. "This discovery constitutes an important milestone and will hopefully enable us to build quantum networks in a few years."

In current communication networks, information is sent through pulses of light moving through optical fibre and can be stored on computer hard disks for future use. "What we have is similar to this, but it does not use pulses of light," stated Dr Tittel. "In quantum communication we also have to store and retrieve information, but in our case, the information is encoded into entangled states of photons."

To achieve this task, the researchers, in collaboration with the University of Paderborn, used a crystal doped with rare earth ions and cooled it to -270°C. At this temperature, the materials properties changed and allowed the scientists to store and retrieve the photons without measurable degradation.

"The resulting robustness and the possibility to integrate the memory with current technology, such as fibre optic cables, is important when moving the currently fundamental research towards applications," said Tittel, who claims the networks will allow people to send information without being afraid of somebody listening in. "The results show that entanglement is not as fragile as is generally believed."

The California Institute of Technology (www.caltech.edu) was recently able to enable quantum entanglement for a quantum state stored in four spatially distinct atomic memories. Researchers also demonstrated a quantum interface between the atomic memories - representing something akin to a computer hard drive for entanglement - and four beams of light, thereby enabling the four fold entanglement to be distributed by photons across quantum networks. (www.newelectronics.co.uk/article/29629/Caltech-research-paves-the-way-toward-quantum-hard-drives.aspx)

The research marked an important achievement in quantum information science by extending the coherent control of entanglement from two to multiple spatially separated physical systems of matter and light.

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Supporting Information
http://www.caltech.edu/
http://www.ucalgary.ca/
http://www.uni-paderborn.de/en/