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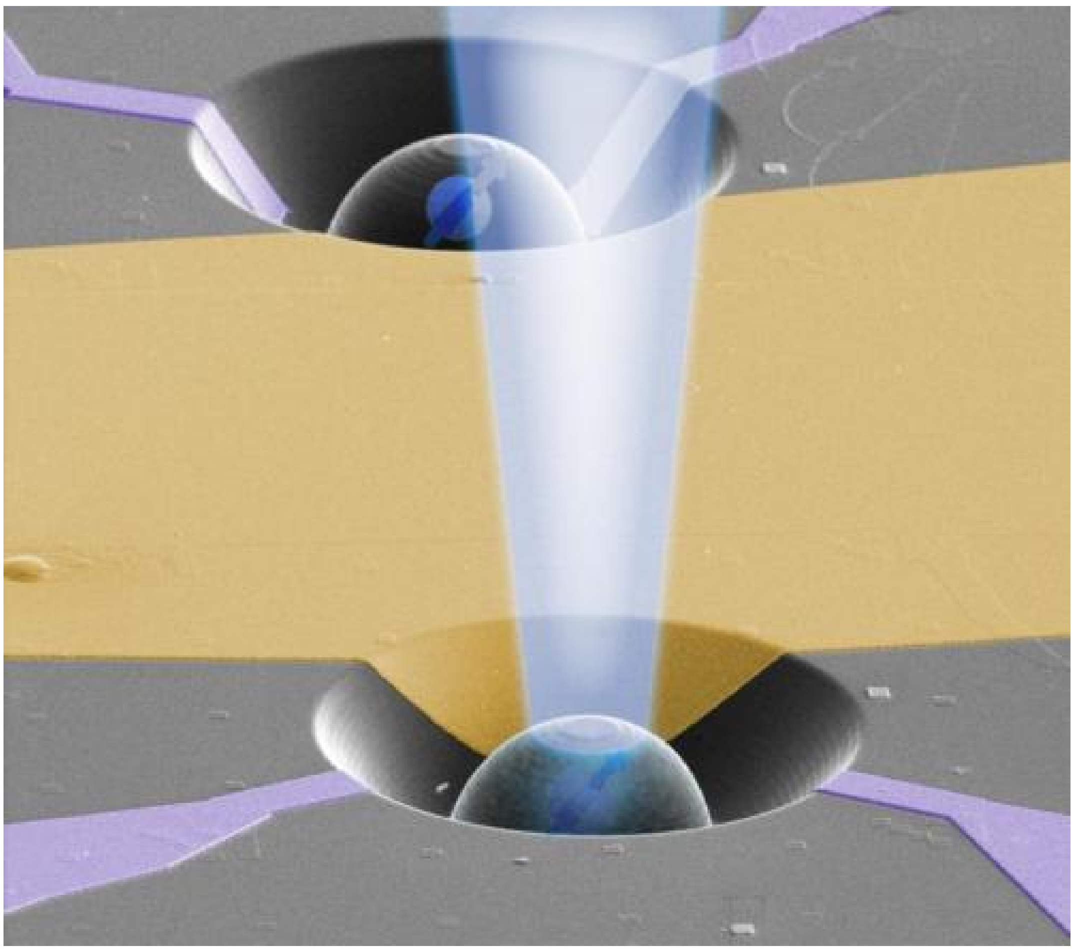
Research team claims to have accurately 'teleported' quantum information ten feet

May 30 2014, by Bob Yirka

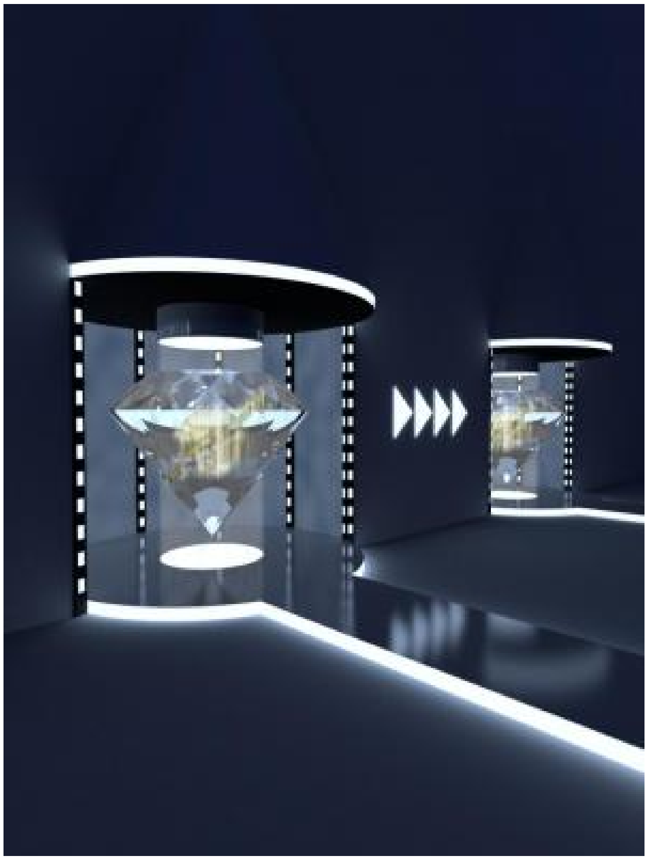


This image is an electron microscope picture of one of the two devices, with a fictitious teleportation beam added. The image is about 40 micrometer wide in reality.

(Phys.org) —A team of researchers at Delft University in the Netherlands is reporting in a paper they have had published in the journal *Science*, that they have successfully used entanglement as a means of communication, over a distance of ten feet (three meters). Furthermore, they note, they did so with 100 percent reliability and without altering the spin state of the quantum bits (qubits) involved.

Teleportation, is of course, a means of moving an object from one place to another without it having to travel between them. Thus far examples of it have only been seen in science fiction movies. The idea of moving information in similar fashion, however, has met with some, albeit limited success. The idea is to use the concept of entanglement of particles as a means of conveyance. It's supposed to work because of the strange interconnectedness of the two particles—whatever happens to one, automatically happens to the other, regardless of the distance between them. Such a property should allow then, for the exchange of information. If the spin state of one qubit is altered, then it should be automatically altered in the other qubit—a form of information exchange which can be counted as a message of sorts if a string of such transactions can be carried out.

To date, scientists have struggled to use entanglement as a means of communication—it's been achieved but the error rate has been so great that it would be unfeasible as a real-world application. In this new effort, the researchers claim to have solved the error rate problem—they've brought it down to zero percent. They did it, they report, by trapping electrons in diamonds at very low temperatures and shooting them with lasers, resulting in the creation of qubits. The diamonds, the team reports, serve as really tiny prisons, holding the electrons in place. Held as they were, the researchers were able to cause a spin state to exist and then to read it at both locations, which meant that information had been conveyed.



Artistic impression of quantum teleportation of a spin state between two distant diamonds.

The research team next plans to extend the distance between the qubits to 1,300 meters, while others presumably will attempt to replicate the first result—if the claims prove true, the breakthrough could mark the first stage of a the development of a true quantum computer, or network.

More information: Unconditional quantum teleportation between distant solid-state quantum bits, *Science* DOI: 10.1126/science.1253512

ABSTRACT

Realizing robust quantum information transfer between long-lived qubit registers is a key challenge for quantum information science and technology. Here, we demonstrate unconditional teleportation of arbitrary quantum states between diamond spin qubits separated by 3 m. We prepare the teleporter through photon-mediated heralded entanglement between two distant electron spins and subsequently encode the source qubit in a single nuclear spin. By realizing a fully deterministic Bell-state measurement combined with real-time feed-forward quantum teleportation is achieved upon each attempt with an average state fidelity exceeding the classical limit. These results establish diamond spin qubits as a prime candidate for the realization of quantum networks for quantum communication and network-based quantum computing.

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Press release: phys.org/wire-news/162888651/beam-me-up-data.html