**Quantum computers can talk to each other via a photon translator**

By **Sophia Chen**

We know what we’d like to use for the innards of future quantum computers: exotic things like pink diamonds and cold atoms. But getting these components to talk to each other has been a challenge. Now, researchers have come up with a way to allow one component to efficiently transmit information to another, without losing its quantum character.

[Quantum computers](https://www.newscientist.com/round-up/quantum-buyers-guide/) are theoretically capable of running calculations exponentially faster than classical computers, and can be made by exploiting [atoms](https://www.newscientist.com/article/dn28286-basic-quantum-computation-achieved-with-silicon-for-first-time/), superconductors, [diamond crystals](http://www.nature.com/news/diamond-shows-promise-for-a-quantum-internet-1.12870) and more. Each of these has its own strengths: atoms are better at storing information, while superconductors are better at processing it. A device linking these diverse systems together would combine their strengths and compensate for their weaknesses.

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| Once linked, these systems would talk to each other by sending and receiving photons. The photons would encode quantum states but, unlike the voltages and currents interpreted by a classical computer chip, they cannot be transmitted via copper wires. |

**Matching spreads**

What’s more, quantum rules require that a single photon must essentially carry a spread of frequencies, rather than a single frequency. For different components to talk to each other using photons, the spread of the sender’s photons must therefore be converted to the spread that the receiver can handle. That requires a device in the middle that can convert photons from one spread of frequencies to another, while still preserving their delicate quantum state.

Christine Silberhorn of the University of Paderborn in Germany and her colleagues have designed such a system. It includes a converter that “translates” photons emitted from one component into the infrared. That infrared photon is then transmitted over a [fibre optic cable](https://www.newscientist.com/article/2106326-quantum-teleportation-over-7-kilometres-of-cables-smashes-record/) connected to a second component. Finally, the photon is translated into another frequency that the receiving component can read.

Only part of the system has been built so far: the researchers have managed to convert infrared photons to a visible wavelength – while leaving their quantum state intact – with a success rate of about 75 per cent. But the technique could be adapted to build the full system, Silberhorn says.

Once that is done, the next step would be to figure out how to fit the device on a chip that could be manufactured easily and cheaply in large quantities, says [Arka Majumdar](http://www.engr.washington.edu/facresearch/newfaculty/2013/arkamajumdar.html) of the University of Washington in Seattle. “The science works,” he says. “But scalability is the biggest problem. Making the same device 1000 times is extremely difficult.”