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Researchers at the University of Ottawa manage to send a message with high-dimensional quantum encryption between two building rooftops, marking a first successful test for the transmission of such signals.

Quantum encryption uses photons to encode information as quantum buts. The simplest form of quantum encryption is 2D, where each photon encodes one bit (either 1 or 0), but a photon can encode even more information, making "high-dimensional quantum encryption." The scheme used by the University of Ottawa is referred to as "4D," because each photon encodes 2 bits of information. This provides 4 possibilities, namely 01, 10, 11 and 00.

High-dimensional quantum encryption sends more information per photon. It is also more tolerant to signal-obscuring noise (such as turbulent air, failed electronics and detectors) before the transmission becomes unsecure. The real world test involved optical setups set on two rooftops 0.3km apart, and had the messages showing an error rate of 11%, below the 19% threshold required to maintain a secure connection.

The next tests will involve sending signals horizontally to a distance of around 3km-- roughly equal to sending a signal through the Earth's atmosphere to a satellite-- before an attempt at a network including 3 links that are 5.6km apart. This test will use adaptive optics, a technology able to compensate for turbulence.

“Our work is the first to send messages in a secure manner using high-dimensional quantum encryption in realistic city conditions, including turbulence,” research team lead Ebrahim Karimi says. “The secure, free-space communication scheme we demonstrated could potentially link Earth with satellites, securely connect places where it is too expensive to install fiber, or be

used for encrypted communication with a moving object, such as an airplane.”

Go [High-Dimensional Quantum Encryption Performed in Real-World City Conditions for First Time]