Toward unbreakable encrypted messages

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Chinese researchers recently announced a landmark advancement: They used a satellite orbiting Earth to beam pairs of quantum-entangled photons to two Tibetan mountaintops more than 700 miles apart. This distance blew the previous record out of the water. But according to an article in *Chemical & Engineering News* (*C&EN*), the weekly newsmagazine of the American Chemical Society, this is only the beginning for quantum communication.

The idea behind quantum communication has been around since the 1960s. It involves using quantum-entangled photons to send encrypted messages. Messages are encoded through a method called quantum key distribution that enables the laws of physics to protect the information being delivered. This means if anyone intercepts and alters the message, the photons' properties will be changed as well, and this would be obvious to the recipient. But scientists are hindered by their ability to produce large numbers of entangled photons that can travel long distances. The Chinese satellite relied on an engineered crystal and laser to create the entangled photons, but the team only detected one pair of photons per 6 million pairs generated because of losses during transmission through the atmosphere.

While looking for more efficient photon sources, scientists have focused on single-photon emitters. Contenders include modified diamonds and quantum dots. The diamonds contain a "color center" defect, which means a glint of color is produced when light passes through. The problem is that only a fraction of light escapes the crystal. Quantum dots are another option, but they either require impractical cryogenic

temperatures to operate or perform inconsistently. Researchers are also investigating ways to transmit entangled photons on Earth using fiber optics, by generating single photons with carbon nanotubes. But further development is needed on all methods for quantum communications to become practical.

More information: "Seeking materials to send unbreakable codes," cen.acs.org/articles/95/i36/Se … breakable-codes.html

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