Research News

Toward an unhackable quantum internet

Researchers demonstrate the missing link for a quantum internet

Researchers have built the missing link for an ultra-secure quantum internet.

Credit and Larger Version (/discoveries/disc_images.jsp?cntn_id=300266&org=NSF)

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A quantum internet could be used to send un-hackable messages, improve the accuracy of GPS, and enable cloud-based quantum computing. For more than twenty years, dreams of creating such a quantum network have remained out of reach in large part because of the difficulty of sending quantum signals across large distances without loss.

Now, Harvard (/cgi-bin/good-bye?https://www.seas.harvard.edu/news/2020/03/towards-unhackable-quantum-internet) and MIT researchers have found a way to correct for signal loss with a prototype quantum node that can catch, store and entangle bits of quantum information. The research is the missing link toward a practical quantum internet and a major step forward in the development of long-distance quantum networks.

"This demonstration is a conceptual breakthrough that could extend the longest possible range of quantum networks and potentially enable many new applications in a manner that is impossible with any existing technologies," said Mikhail Lukin, co-director of the Harvard Quantum Initiative. "This is the realization of a goal that has been pursued by our quantum science and engineering community for more than two decades."

The National Science Foundation <https://www.nsf.gov/awardsearch/showAward?AWD_ID=1541959&HistoricalAwards=false> -funded research is published in *Nature* (/cgi-bin/good-bye?https://www.nature.com/articles/s41586-020-2103-5).

Every form of communication technology -- from the first telegraph to today's fiberoptic internet -- has had to address the fact that signals degrade and are lost when transmitted over distances. Repeaters, which receive and amplify signals to correct for this loss, were first developed to amplify fading wire telegraph signals in the mid-1800s. Two hundred years later, repeaters are still an integral part of our long-distance communications infrastructure.

The new device combines the three most important elements of a quantum repeater -- a long memory, the ability to efficiently catch information from photons, and a way to process it locally.

"If we compare the quest for a secure quantum internet to the 1960s mission to deliver Americans to the surface of the moon and return them safely to Earth," says Filbert Bartoli, director of NSF's Division of Electrical, Communications and Cyber Systems, "the demonstration of quantum repeaters may be of comparable significance to the demonstration of detachable rocket boosters, which allowed astronauts to escape Earth's atmosphere, or to the heat resistant shields that allowed them to return safely to Earth and not burn up on reentry to Earth's atmosphere."

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