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GENERAL NEWS

China Makes Leap Toward 'Unhackable' Quantum Network

Team beams particles from space in advance for quantum communications

A composite photo taken in December shows a satellite-to-earth link established between the Chinese satellite "Micius" and an experiment platform in Tibet. PHOTO: JIN LIWANG/XINHUA/GETTY IMAGES

By Josh Chin

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BEIJING—Chinese scientists have succeeded in sending specially linked pairs of light particles from space to Earth, an achievement experts in the field say gives China a leg up in using quantum technology to build an "unhackable" global communications network.

The result is an important breakthrough that establishes China as a pioneer in efforts to harness the enigmatic properties of matter and energy at the subatomic level, the experts said.

In an experiment described in the latest issue of Science, a team of Chinese researchers used light particles, or photons, sent from the country's recently launched quantum-communications satellite to establish an instantaneous connection between two ground stations more than 1,200 kilometers (744 miles) apart.

Using the quantum properties of tiny particles to create a secure communications network is scientifically and technically demanding, according to security researchers, and China is years away from being able to build one.

If China ultimately succeeds, such a system could undermine U.S. advantages in penetrating computer networks.

The Pentagon, in an annual report on China's military delivered to Congress last week, described the quantum satellite launch in August as a "notable advance in cryptography research."

While the U.S. is also pursuing quantum communications, it has concentrated more attention and resources on research into quantum computing. European physicists have developed many of the theories and basic practices underlying quantum encryption, but their Chinese counterparts are better-funded with government resources.

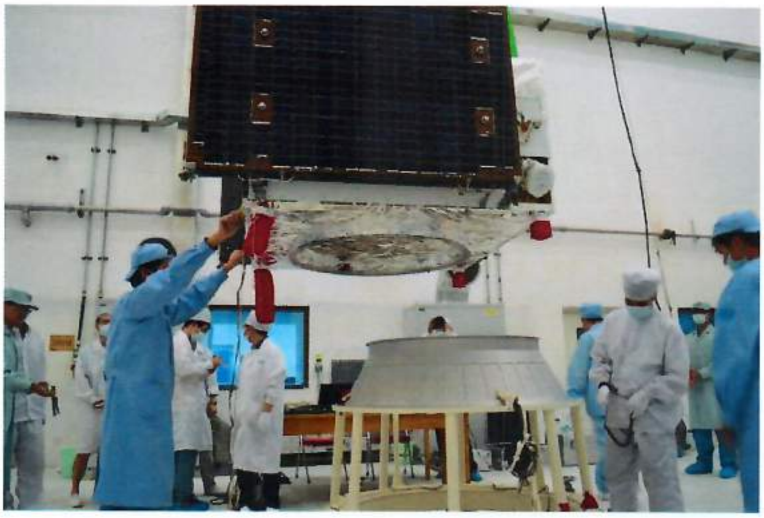
Disclosures by former National Security Agency contractor Edward Snowden in 2013 about U.S. spying on Chinese networks rattled Beijing, and have pushed the country to bolster cybersecurity measures in a variety of ways.

"The Snowden revelations undoubtedly played a part in the drive towards quantum technologies, as it revealed the degree of sophisticated threat Chinese counterespionage and cyberdefenses were facing," said John Costello, a fellow specializing in China and cybersecurity at the nonpartisan Washington-based think tank New America.

The experiment exploited a phenomenon of quantum mechanics that allows two particles to be entangled so that whatever happens to one is immediately reflected in the physical state of the other, no matter how far apart they are. Albert Einstein once described this as "spooky action."

By using a satellite, the Chinese scientists avoided the interference at ground level that had limited transmissions of entangled particles to around 100 kilometers.

"The Chinese experiment is quite a remarkable technological achievement," said Artur Ekert, a professor in quantum physics and cryptography at Oxford



Technical staff in northwest China prepared in August for the launch of the Micius satellite. PHOTO: XINHUA/GETTY IMAGES

University.

Anton Zeilinger, a physicist at the University of Vienna who is working with Chinese researchers on a different experiment involving the satellite, said the result had exceeded his expectations.

The Chinese team behind this week's report was led by physicists from University of Science and Technology of China in the eastern city of Hefei. The university also led development of the satellite, named Micius after a fifth-century B.C. philosopher.

Photons and other subatomic particles can be encoded with cryptographic keys—the kind used to scramble and unscramble messages. The state of a particle changes as soon as it is intercepted, making it impossible for a third party to steal the key without alerting the intended recipient.

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Quantum encryption can be defeated when it isn't used properly, said Alexander Ling, an expert in quantum communications at the Center for Quantum Technologies in Singapore.

Deployed correctly, quantum encryption would protect data against conventional snooping and protect networks against efforts in the U.S. and elsewhere to build quantum computers powerful enough to defeat the math-based encryption currently in use.

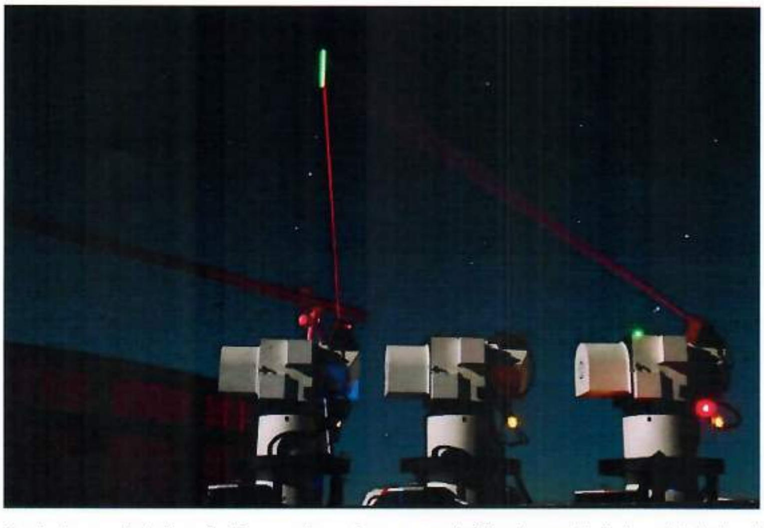
The process described by the Chinese researchers in this week's report is too slow and complex to be used for practical quantum communications, said Gregoire Ribordy, co-founder of Geneva-based quantum cryptography firm ID Quantique. Mr. Ribordy's company recently formed a joint-venture to sell quantum-communications equipment in China—photon generators and receivers for the exchanging of encryption keys through land-based, optic-fiber networks.

But he said that China would be able to connect its embassies and other government facilities around the world by launching a second quantum satellite to expand the transmission range—something he predicted could happen within five years.

"They could do large-scale, global-scale quantum communications," said Mr. Ribordy. "They've gathered experience with this satellite."

Lu Chaoyang, one of the physicists at the University of Science and Technology of China who worked on the project, said the Chinese research team was working to speed up the transmission process, but defended the progress they had already made.

"We have achieved a two-proton entanglement distribution efficiency a trillion times more efficient than using the best telecommunication fibers," he said. "We done something that was absolutely impossible using conventional approaches."



A photograph taken in December shows a satellite-to-earth link established between the Micius satellite and an experiment platform in Tibet. PHOTO: JIN LIWANG/XINHUA/GETTY IMAGES

Write to Josh Chin at josh.chin@wsj.com

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