Secure metropolitan quantum networks move a step closer

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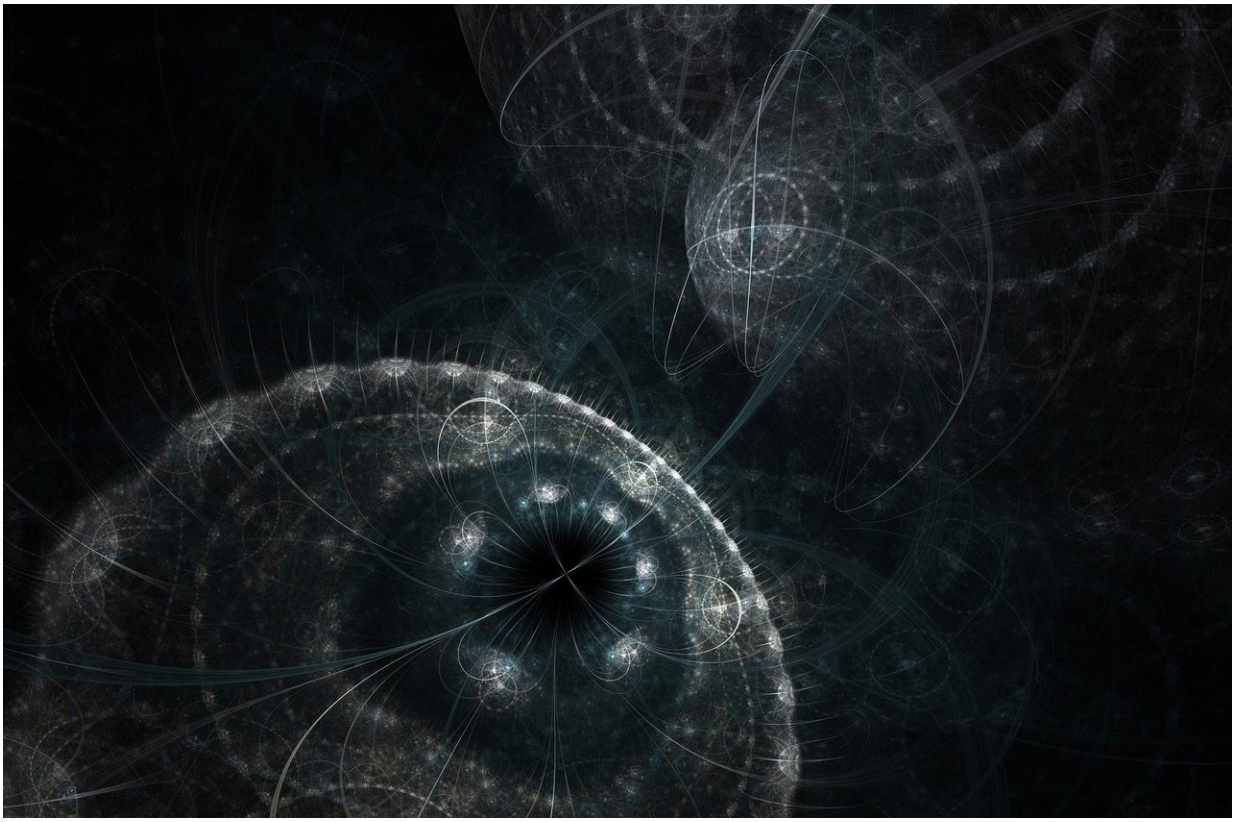

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Successful new field tests of a continuous-variable quantum key distribution (CV-QKD) system over commercial fiber networks could pave the way to its use in metropolitan areas.

That is the key achievement from a joint team of Chinese scientists, published today in *Quantum Science and Technology*, which demonstrates CV-QKD transmission over commercial deployed fiber link with a distance of 50 kilometres.

Team leader and lead author, Prof. Hong Guo, from a joint team of Peking University and Beijing University of Posts and Telecommunications (PKU-BUPT joint team), Beijing, said: "CV-QKD provides, in principle, unconditional secret keys to protect people's data—such as banking information, emails and passwords.

"It has attracted much attention in the past few years, because it uses standard telecom components that operate at room temperature, instead of specific quantum devices such as single photon detectors etc, and it has potentially much higher secret key rates. However, most previous long-distance CV-QKD demonstrations were only done in laboratory fiber, without the disturbances caused by the field environment."

Lead authors Dr. Yichen Zhang and Prof. Song Yu, from the PKU-BUPT joint team, Beijing, said: "There are several challenges to bringing a practical CV-QKD system from a laboratory setup to the real world. Deployed commercial dark fibers are inevitably subject to much stronger perturbations from changing environmental conditions and physical stress. This in turn causes severe disturbances of the transmitted quantum states.

"They also suffer from higher losses due to splices, sharp bends and inter-fiber couplings. The software and hardware of CV-QKD modules must not only be designed to cope with all the conditions affecting the transmission fiber, but must also be robustly engineered to operate in premises designed for standard telecom equipment. Furthermore, as the systems need to run continuously and without frequent attention, they need to be designed to automatically recover from any errors and shield

end users from service interruptions."

The PKU-BUPT joint research team carried out two field tests of CV-QKD over commercial fiber networks in two cities of China—Xi'an and Guangzhou—achieving transmission distances of 30.02 km (12.48 dB loss) and 49.85 km (11.62 dB loss), respectively.

Prof. Hong Guo said: "The longest previous field tests of a CV-QKD system were over a 17.52 km deployed fiber (10.25 dB loss) and a 17.7 km deployed fiber (5.6 dB loss), where the secret key rates were 0.2 kbps and 0.3 kbps, respectively.

"Comparing with these results, our results show a more than twice transmission distance, and a two orders-of-magnitude higher secret key rates, though in more lossy commercial fiber links.

"This is a significant step in bringing CV-QKD closer to everyday use. It has pushed CV-QKD towards a more practical setting, and, naturally, one may expect that a quantum-guaranteed secure metropolitan network could be built within reach of current technologies."

More information: Yichen Zhang et al. Continuous-variable QKD over 50 km commercial fiber, *Quantum Science and Technology* (2019). DOI: 10.1088/2058-9565/ab19d1

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