



Chinese Researchers Demonstrate Mobile Quantum Satellite Base Station

OE Watch Commentary: In late December, a Chinese mobile quantum satellite ground station, the first of its kind in the world, successfully connected to Micius, a quantum testbed satellite 500 km above in orbit. The connection or “handshake” described in the accompanying article is the negotiation between two communication systems that allow data to be transmitted. Afterward it was able to exchange secret keys, the information used to encrypt and decrypt information in an encryption scheme. Passing this information through quantum links ensures their security.

Micius, also called Mozi after the ancient Chinese philosopher, is part of Quantum Experiments at Space Scale (QUESS), one of the scientific experiments under China’s space science Strategic Priority Program. The satellite was launched on 16 August 2016 by the Chinese Academy of Sciences with the goal of helping make breakthroughs in long-distance quantum communications.

According to Dr. Pan Jianwei [潘建伟], the main goals of the program are quantum key distribution from a satellite to ground station, a global-scale quantum communication network that uses satellites and fiber-optic cables, long-range entanglement testing involving two ground stations over 1,000 kilometers apart and a satellite, and ground-to-satellite teleportation (sending quantum information from one location to another).

Quantum Key distribution is a means of secure communication that takes advantage of the properties of quantum physics. In June 2017, China successfully entangled photons at two ground stations 1203 km apart, relayed through Micius. Successful links were later established between Beijing and Vienna. Chinese leaders see their communications as very vulnerable to interception, as evidenced by a campaign to divest Chinese networks of US-made servers and other equipment.

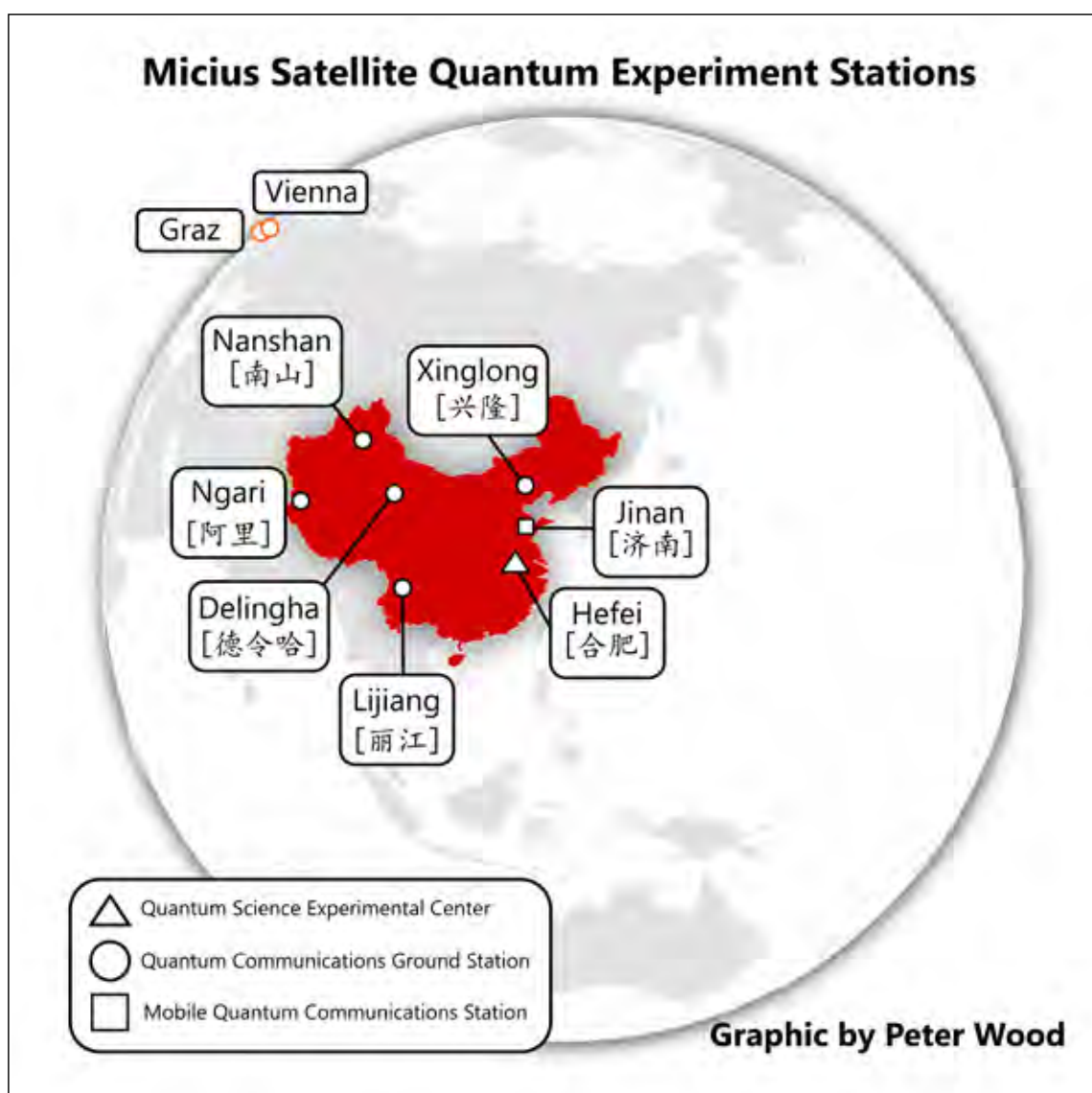
To communicate with the satellite, China has built a number of ground stations across the country as part of its experimentation with long-range quantum communications. The key research lab and coordinating center for the project are based in Hefei [合肥], Anhui province with ground stations in Nanshan [南山], Xinjiang, Ngari (Ali [阿里]) Tibet, Delingha [德令哈], Qinghai and Xinglong [兴隆], Hebei province. Austrian labs in Vienna and Graz are also part of the ground-station network.

Developed by the University of Science and Technology of China, QuantumCTek Co., Ltd. and the Jinan Quantum Technology Research Institute [济南量子技术研究院], the mobile station is based in Jinan, Shandong province.

China has several mobile satellite ground stations that support the national network, ensuring monitoring and communication with the growing number of satellite constellations. While the “bucket-size” telescope and accompanying transmission equipment are dwarfed by the radar dishes of the other mobile stations, the quantum base station nevertheless represents an important breakthrough.

As noted by Zhang Qiang [张强], the executive dean of the Jinan Institute, the new system is much smaller than the other ground stations used by the program in the past and opens the door to the commercialization of the technology.

As the second accompanying excerpt reports, in addition to the January deployment of the mobile station, in May, the QUESS program successfully transferred time-synchronization data securely using quantum communications. This is an important step toward building secure satellite navigation systems. China hopes to deploy the technology widely across many technological fields to improve the overall security of communications while making advances in the field of quantum physics. **End OE Watch Commentary (Wood)**





Continued: Chinese Researchers Demonstrate Mobile Quantum Satellite Base Station

“This mobile quantum satellite ground station represents a breakthrough in the commercialization of quantum technology. The ground station used for the launch of Micius weighed more than a dozen tons. After thousands of experiments, the researchers successfully miniaturized the ground station, significantly reducing the manufacturing cost. The portable station can be loaded onto vehicles anytime and anywhere, giving it great commercialization potential in the future.”

— Zhang Qiang [张强], professor at the University of Science and Technology of China and executive dean of the Jinan Institute of Quantum Technology

Source: “全球首个可移动量子卫星地面站与‘墨子号’成功握手 (World’s First Mobile Quantum Satellite Ground Station Successfully Executes ‘Handshake’ with ‘Micius’ Satellite),” S&T Daily, 2 January 2020. <http://scitech.people.com.cn/n1/2020/0102/c1007-31531958.html>

On 30 December 2019, between 23:31 and 23:39, on the roof of the Jinan Quantum Technology Research Institute, the mobile quantum satellite ground station emitted a red light, looking for a little green light passing through the sky. The “red” and the “green” “shook hands,” achieving satellite-to-ground linkup. The green light was emitted by the Micius quantum satellite that was launched in 2016. Today, with the transit of “Micius” and its subsequent handshake with the mobile quantum satellite ground station, a massive encrypted transmission of information was completed in a matter of minutes.

The first linkup of the world’s first mobile quantum satellite ground station with Micius lasted about eight minutes. Once the linkup is complete, Micius can transmit the secret key and the ground station in Jinan can receive it and conduct a secret key test.

The Jinan Quantum Technology Research Institute kicked off the miniaturized quantum communication satellite ground station system project in 2019; the ground station was completed on 24 December. The successful handshake test with the “Micius” quantum scientific experimental satellite marked the completion of China’s first miniaturized mobile quantum satellite ground station in Jinan.

This ground station is about the size of a paint bucket and weighs a little over 80 kilograms. Adding a 28 cm telescope and equipment turns it into a mobile quantum satellite ground station. This project was undertaken together by the University of Science and Technology of China, QuantumCTek Co., Ltd. and Jinan Quantum Technology Research Institute.

Zhang Qiang [张强], professor of the University of Science and Technology of China and executive dean of the Jinan Institute of Quantum Technology, explained that this mobile quantum satellite ground station represents a breakthrough in the commercialization of quantum technology. The ground station used for the launch of Micius weighed more than a dozen tons. After thousands of experiments, the researchers successfully miniaturized the ground station, significantly reducing the manufacturing cost. The portable station can be loaded onto vehicles anytime and anywhere, giving it great commercialization potential in the future.

At present, the Jinan Quantum Communication Test Network has been successfully connected to the “Beijing-Shanghai Main Line” and has become an important part of China’s wide-area quantum communication network.

Source: “Chinese experts use quantum satellite to ensure time information security,” Xinhua, 14 May 2020. <http://global.chinadaily.com.cn/a/202005/14/WS5ebc9f35a310a8b2411558f9.html>

Experts used China’s quantum satellite -- Quantum Experiments at Space Scale (QUESS) -- to verify quantum-secure time transfer for the first time, which laid a foundation for building a safe satellite navigation system.