universität wien
Fakultät für Physik

IQOQI Vienna

INVITATION

to a **TALK** by

Jian-Wei Pan

University of Science and Technology of China (USTC)

"Dream or Reality Quantum Communication: the Past, Present and Beyond"

followed by a **PANEL DISCUSSION**
with

Jian-Wei Pan, USTC

Anton Zeilinger, University of Vienna & IQOQI/ÖAW

moderated by **Markus Aspelmeyer**, University of Vienna & IQOQI/ÖAW

Thursday, 22 June 2023
13:00

Christian Doppler Lecture Hall
Faculty of Physics, University of Vienna
Boltzmanngasse 5, 3rd floor

The event will be preceded by a reception starting at 12:00.

universität wien
Fakultät für Physik

IQI Vienna

Dream or Reality Quantum Communication: the Past, Present and Beyond

In this talk, I will give an overview on the 40 years' long history of quantum communications and show how this field has evolved from a pure theoretical idea into an emerging technology. The privacy and security underpin human dignity and is one of the most important human rights. However, every advance in classical cryptography has been defeated by advances in cracking. In 1984, Charles Bennett and Gilles Brassard theoretically ended the encryption-decryption battle by inventing quantum cryptography. However, there are major challenges to turn this idea into practically secure and large-scale quantum communications. I will discuss the experimental efforts to close security loopholes in the quantum key distribution using realistic devices, and go to long distance practically useful at a global scale. One possible solution for large-scale quantum communication is quantum repeater. After 20 years of development, quantum repeaters enable quantum communication at a distance of 500 km. More effectively, by developing a quantum science satellite *Micius* and exploiting the negligible decoherence and photon loss in the out space, practically secure quantum cryptography, entanglement distribution, and quantum teleportation have been achieved over thousand-kilometer scale. The systematic technologies developed in quantum communications are also widely applicable for other optical quantum information processing tasks, especially the demonstrations of quantum computational advantage with up to hundreds of photons.

In future, it is foreseen to establish a global quantum communication network and quantum internet with metropolitan quantum communication network, inter-city quantum communication connected by quantum repeaters, and long-distance quantum communication with quantum satellites including the quantum constellation and GEO quantum satellite. Moreover, a GEO satellites carring a ultra-precise optical clock also provides new platform for the study of quantum metrology such as precise timing information sharing, and can even provide the possibility of new probes for fundamental physics.