

2nd Prize: Doctoral student Alberto Boaron and Dr. Davide Rusca for their work at the Laboratory of Applied Physics at the University of Geneva under the supervision of Prof. Hugo Zbinden.

Subject: long distance quantum key distribution.

The second prize was awarded to two researchers of the Department of Applied Physics at the Faculty of Science of the University of Geneva: the collaboration of Alberto Boaron and Davide Rusca in the laboratory of Prof. Hugo Zbinden has allowed them to make major advances in the field of quantum communication at the theoretical and experimental level.

This technique has the potential to ensure the transmission of encrypted data in absolute confidentiality. It is based on the secure distribution of a Quantum Key Distribution (QKD) using light particles, the photons, which have been put into a quantum state. The maximum distance and key transmission rate are limited by physical constraints (attenuation in the transmission medium, efficiency and noise of the detection system) and by the protocols used to detect a spying attack and to prevent it.

The maximum distance at a given transmission rate is often used to characterize the performance of a QKD system. Initially, the two researchers improved the protocols as a theoretical work: They simplified the most used method for the detection of an intrusion and could show that it is possible to reduce the quantity of photons prepared for the QKD. Based on the most used protocol in this field, established in 1984 by Charles Bennett and Gilles Brassard, they also developed a new protocol that requires fewer prepared photons and they were able to demonstrate its safety.

Relying on these innovations they were able to set new records for distance and transmission rates. Using standard single-mode fiber optics and commercially available semiconductor sensors they were able to transmit over 200km, keys at a rate of 1.2 kHz, which is a thousand times higher than the best results published so far.

Using a detector based on superconducting technology they managed to set a new maximum distance record (421km) and they demonstrated a transmission rate of 6.5 bit / s over 405 km, four orders of magnitude higher than a comparable experience done in 2016 in China.

