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AN OPTICAL GROUND STATION FOR SPACE BASED QUANTUM KEY DISTRIBUTION

Abstract

Quantum key distribution serves as the cornerstone for future global quantum networks. In this connection, network nodes in space help overcome distance limitations on Earth and enable secure communication between distant points on ground. Doing so, however, requires stations on ground that can receive and analyze the weak quantum signals with high accuracy.

Here we report on the design and operational concept of the optical ground station we are currently building in Singapore. We elaborate on the purpose and design drivers of the major subsystems, which include the telescope system, quantum receiver, polarization correction system, and the pointing, acquisition and tracking system. The latter system, in turn, comprises a beacon, which is used to establish a line-of-sight with the satellite before transmitting the quantum signals. Our ground station supports a range of beacon wavelengths to ensure compatibility with various missions, and is capable of receiving and analyzing the polarization state of photons around 800nm.

We have ordered the main commercial components and are currently developing a demonstrator of the optical system for testing under various loads, thus simulating the forces it will experience when mounted to the telescope. We expect the ground station to be operational by the end of 2022.