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NANOCRYPTO - QUANTUM-BASED OPTICAL CRYPTOGRAPHIC KEY AND DATA
DISTRIBUTION SYSTEM

Abstract

The nanoCRYPTO project is focused on delivering the technology for secure and reliable quantum cryptographic services over satellite-to-ground communication links. The project will implement an innovative and secure optical satellite communication system that combines transmission of data with the quantum-based generation of a secret key, which will enable the distribution of cryptographic keys on a global scale. In the project, the team will test a scenario in which a satellite equipped with a VIS camera captures an EO image and encrypts the image using a secret key generated by the cryptographic module for downlink transmission. The image is then decrypted using the provided key. This is just one example of how the technology developed in the project could be used in real-world scenarios; other potential applications include using it to distribute secret keys between remote locations to encrypt ground-based communication channels, and to securely transmit sensitive data. Apart from the orbital segment consisting of the satellite bus, cryptographic module, laser communications module and a VIS camera, the system will also include a dedicated ground segment. It will consist of two optical ground stations and one radio ground station. The role of the optical ground stations will be to receive both downlink data and the generated secret key. The radio ground station will help with transferring telemetry and telecommand data. In addition to providing enhanced security and privacy for satellite-based communication systems, the nanoCRYPTO project is expected to prove that a reliable satellite quantum key distribution system can be implemented at significantly reduced cost. This cost reduction will be achieved through the use of a simplified satellite communication terminal design in comparison with conventional single photon-based quantum key distribution systems, as well as the use of smaller and cheaper satellite platforms. This will make the system more adaptable and affordable, and could open up new possibilities for secure satellite-based communication. The nanoCRYPTO project has the potential to revolutionize the way we transmit sensitive information from space. By leveraging the unique properties of quantum mechanics, the project will provide unparalleled security and privacy for satellite-based communication systems, enabling the transmission of sensitive data with confidence. The project is expected to have a significant impact on the field of satellite-based communications, and could pave the way for a new era of secure and reliable data transmission from space. K. Banaszek et al., Opt. Express 29, 43091 (2021)