

## Secure communications in quantum networks

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Quantum technologies have the potential to improve in an unprecedented way the security and efficiency of communications in network infrastructures. We discuss the current landscape in quantum communication and cryptography, and focus in particular on recent photonic implementations, using encoding in discrete or continuous properties of light, of central quantum network protocols, enabling secret key distribution, verification of multiparty entanglement and transactions of quantum money, with security guarantees impossible to achieve with only classical resources. We also describe current challenges in this field and our efforts towards the miniaturization of the developed photonic systems, their integration into telecommunication network infrastructures, including with satellite links, as well as the practical demonstration of novel protocols featuring a quantum advantage for a wide range of tasks. These advances enrich the resources and applications of the emerging quantum networks that will play a central role in the context of future global-scale quantum-safe communications.

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