rámcové téma: Quantum Transfers in Real-life Networks

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abstrakt:
Quantum transfers are essential to the recent applications in quantum sensing, quantum metrology, quantum computation, and quantum key distribution (QKD). Currently, the primary focus of research in the field of quantum technologies is on quantum computation and QKD. Quantum computation can solve specific tasks much faster than their classical counterparts, posing a security risk to current encrypted communication as the safety of cryptography schemes relies on the computational difficulties of inverse mathematical operations, which can be easily solved by quantum computers. Fortunately, the QKD protocol framework for secure communication relies on the intrinsic properties of quantum mechanics, which demand security by physical means.

A fully operational QKD protocol utilizes a quantum channel to transfer qubits and a classical channel to share complementary information about the qubit measurement, enabling the detection of an eavesdropping attack. QKD has been thoroughly studied from both a theoretical and experimental perspective and is now being implemented on existing optical fiber networks. There are several classes of QKD approaches distinguished by the use of entanglement phenomenon or the type of variable transferred, either discrete or continuous. The main difficulties in transferring quantum states are attenuation in fibers, which limits the reach of single photons, time synchronization, and disturbances in the utilized degrees of freedom.

Certainly, quantum transfers over optical fiber networks will be an indispensable feature of many future quantum applications, including QKD. The development of quantum transfer technologies and methods for real-life networks, the frame topic of intended Ph.D. study, is a vital area of research in the field of quantum technologies. The study will be carried out in collaboration with CESNET association.

reference:

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