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Cost-efficient quantum access network boosts practical deployment of quantum key distribution network

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The security of information is not assured over extended periods, especially with the rapid advancement of quantum computers. To address this challenge, quantum cryptography, rooted in quantum physics, offers comprehensive toolkits for key distribution [1], secret sharing [2], digital signatures [3] and other cryptographic tasks [4] with information-theoretical security. The feasibility of quantum cryptography, particularly quantum key distribution (QKD), has been proven, and this technique is being extended to networks. The quantum access network (QAN) is a representative architecture in QKD networks that enables multiple users to access quantum infrastructure as a last-mile connection [5]. However, the current QAN implementation requires additional hardware for auxiliary tasks, such as time synchronization, which not only increases user costs but also impedes the widespread deployment of quantum networks.

Huang et al. [6] recently proposed a cost-efficient quantum access network employing qubit-based synchronization, thereby significantly reducing the cost and hardware complexity associated with QKD network implementation. The authors employed qubit-based synchronization to conduct a two-user access network experiment, with each user achieving average secure key rates of 53.84 and 71.90 kbps over a 50 km commercial fiber spool. Moreover, the network demonstrated a capacity for 64 users under cross-talk and loss conditions, indicating its potential for practical deployment.

This network architecture introduces a promising quantum network scheme aimed at addressing the challenge of deploying QKD on a larger scale. By combining with a silicon-based transmitter chip [7,8], QANs can be advanced at a lower cost, thus paving the way for secure and efficient QKD networks.

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