Intermodal Quantum Communications

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Quantum communications represent the most concrete example of applications of the second quantum revolution. They allow to obtain security conditions in the exchange of cryptographic keys and in the generation of random numbers that do not have the classical analogue, being based on the Laws of Quantum Mechanics.

In particular, QKD has rapidly developed from experimental systems to concrete protocols and use in real systems. The demand to serve the needs of different users requires the ability to connect on very different distance scales. These include those within a single building, the urban, metropolitan, regional, national and finally continental scales. Intercontinental connections are also provided through the satellite connection.

Although for many of these types of connections, optical fibers represent an excellent solution, it is not always possible to have them due to physical constraints, but also economic and or context-related constraints.

Intermodal links make it possible to overcome this limitation by introducing fiber parts and free space parts. In this case, you can connect users of the . This allows QKD to be implemented between geographically dispersed users in a complex way. At the same time, it is possible to limit the number of boxes that form a key to the bare minimum, with the indirect advantage on the final security of the key distribution network.

In the talk will illustrate how this type of link can be obtained on hybrid switches on an urban scale [1-2], with improved rate exceeding the 10 MBps of fine-key secure key [3] as well as using free space links up to 18 km, with advanced turbulence mitigation systems [4].

Perspectives in the design of scientific experiments based on this technique will also be presented [5-6].

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