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# Multiprotocol interoperable QKD integrated devices

Quantum key distribution (QKD) is the fundamental method employed in quantum communications to guarantee total security in the transmission of information. This is achieved by the utilization of different proposed cryptographic protocols (like BB84, Ekert, MDI...) with different advantages and problems, as well as different strategies of codification (polarization, time-bin, phase, spatial...), useful for different channels and conditions. Thus, development of multiprotocol devices, capable to operate with different protocols, offers the advantage of easy reconfiguration and adaptability to multiple conditions and the possibility of increasing the dimensionality to reinforce security. To achieve this, integrated optics arises as an advantageous platform by means of miniaturization and easy interconnection among components.

In this work, we present the design and development of photonic-integrated QKD terminals capable of interoperate different protocols; in particular polarization, time-bin and phase encoding BB84. These devices are not only capable to easily and rapidly change between different protocol codifications, but also to combine them to increase dimensionality, and thus, bandwidth and security. Additionally, we present and analyze different components required in our devices such as on-chip path-polarization interconverts (2-dimensional diffraction gratings), and nanoantennas for coupling individual photon emitters. We simulate the behavior of the proposed circuits and components, and analyze the quantum key error for different parameters.

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