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The Role of Topology in Quantum Communication

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Topology is a branch of mathematics that studies the properties that remain invariant under continuous deformations (deformations that do not include cutting or tearing). Interest in topological ideas in physics originated in the field of condensed matter physics with the exploration and discovery of topological phases of matter. Furthermore, topology was adopted in quantum computation with quantum error correction and topological model of quantum computation. Recently, there has been an interest in applying topology to photonics; and this has resulted in the field of topological photonics. In essence, topological photonics applies the ideas of topology to the field of photonics. In this paper, we explore the role of topology in quantum communication (quantum communication can be viewed as photonics in quantum regime). In particular, we explore the effects of topology in frequency-coded quantum key distribution (QKD); with focus on topological laser and topological one-way fiber. Quantum bit error rates (QBER) for topologically-assisted frequency-coded variants of the BB84 and the B92 QKD protocols are then analyzed. The results obtained provide a justification for the exploration of topology in quantum communication.

Apply to be considered for a student award (Yes / No)?

No

Level for award (Hons, MSc, PhD, N/A)?

N/A

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