

Detecting the Event of a Single Photon Loss on Quantum Signals

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We design a scheme for detecting a single photon loss from multi-modal quantum signals transmitted *via* fiber or in free space. This consists of a special type of unitary coding transformation, the controlled-squeezing, applied prior to transmitting the signal composed by information and ancilla modes. At the receiver, the inverse unitary transformation is applied -decoding and the ancilla modes are measured *via* photon detection. The outcome reveals whether a photon loss has occurred. Distortion of the information part of the signal caused by an ancilla photon loss can be corrected if the encoding transformation is appropriately selected. Loss of a photon from the information part of the signal can be detected with the probability exponentially close to unity. In contrast to the schemes of decoherence-free subspaces and quantum error correction protocols, this method allows one to make use of the entire Hilbert space dimensionality. We discuss possible ways of synthesizing the required encoding-decoding transformations.