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## Logical channel for heralded and pure loss with the Gottesman-Kitaev-Preskill code

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Photon loss is the dominant source of noise in optical quantum systems. The Gottesman-Kitaev-Preskill (GKP) bosonic code provides significant protection; however, even low levels of loss can generate uncorrectable errors that another concatenated code must handle. In this work, we characterize these errors by deriving analytic expressions for the logical channel that arises from pure loss acting on approximate GKP qubits. Unlike random displacement noise, we find that the loss-induced logical channel is not a stochastic Pauli channel. We also provide analytic expressions for the logical channel for “heralded loss,” when the light scattered out of the signal mode is measured either by photon number counting—i.e. photon subtraction—or heterodyne detection. These offer a pathway to intentionally inducing non-Pauli channels for, e.g., magic-state production.

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