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Quantum Energy Lines and the optimal output ergotropy problem

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We study the possibility of conveying useful energy (work) along a transmission line that allows for a partial preservation of quantum coherence. As a figure of merit we adopt the maximum values that ergotropy, total ergotropy, and non-equilibrium free-energy attain at the output of the line for an assigned input energy threshold. When the system can be modelled in terms of Phase-Invariant Bosonic Gaussian Channels (BGCs), we show that coherent inputs are optimal. For generic BGCs which are not Phase-Invariant the problem becomes more complex and coherent inputs are no longer optimal. In this case, focusing on one-mode channels, we solve the optimization problem under the extra restriction of Gaussian input signals.

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