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Persistence of quantum correlations in a XY spin-chain environment

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Abstract

Quantum correlations in a physical system are usually degraded whenever there is an interaction with the environment. Here we consider the action of a XY spin-chain interacting with a system of two qubits. Results are surprising for particular families of states since their evolution does not destroy the presence of either entanglement or nonlocality, that is, those correlations persist for any possible configuration of the environment. In addition, we unveil the form of those states which, although being mixed, their entanglement implies nonlocality and vice versa. This finding constitutes an extension of the well-known Gisin Theorem for pure states of two qubits. The ensuing form will enable us to find the evolved entanglement and nonlocality in an analytical fashion.

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