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QUANTUM AND CLASSICAL CORRELATIONS IN GAUSSIAN OPEN QUANTUM SYSTEMS*

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Abstract

In the framework of the theory of open systems based on completely positive quantum dynamical semigroups, we give a description of the continuous-variable quantum correlations (quantum entanglement and quantum discord) for a system consisting of two noninteracting bosonic modes embedded in a thermal environment. We solve the Kossakowski-Lindblad master equation for the time evolution of the considered system and describe the entanglement and discord in terms of the covariance matrix for Gaussian input states. For all values of the temperature of the thermal reservoir, an initial separable Gaussian state remains separable for all times. We study the time evolution of logarithmic negativity, which characterizes the degree of entanglement, and show that in the case of an entangled initial squeezed thermal state, entanglement suppression takes place for all temperatures of the environment, including zero temperature. We analyze the time evolution of the Gaussian quantum discord, which is a measure of all quantum correlations in the bipartite state, including entanglement, and show that it decays asymptotically in time under the effect of the thermal bath. This is in contrast with the sudden death of entanglement. Before the suppression of the entanglement, the qualitative evolution of quantum discord is very similar to that of the entanglement. We describe also the time evolution of the degree of

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