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The effect of the classical driving field on the dynamics of entanglement of two qubits interacting with two dissipative cavities

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Abstract

In this article, we first introduce a system consisting of two dissipative cavities, in each of which there is a two-level atom. Each of the atoms is under the influence of a classical laser field, which causes the displacement of their energy levels. The correlation between two cavities is given by the field-field interaction term. We use the Gardiner-Collet model to describe the dissipation in this research. After introducing the Hamiltonian of the system, we simplify the Hamiltonian by using the Fano technique and introducing two sets of new operators. Also, with introducing the atomic bare bases, the Hamiltonian of the system will become a solvable form. Then, by using the technique of Laplace transforms, we solve the time-dependent Schrödinger equation and find the explicit form of the system's wave function at every moment of time. Having the wave function of the atom-atom system and using the concurrence criterion, we investigate the entanglement dynamics of the system in two strong and weak interaction regimes corresponding to the non-Markovian and Markovian regimes. The results show that there will be no stable state of entanglement in this system. We will also show that the classical laser field will play a constructive role in maintaining the initial entanglement as well as the generated entanglement.

Keywords: open quantum systems, entanglement, the Gardiner-Collet Hamiltonian

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