2005 Vol.44 No.2 pp.259-268 DOI:

Generation of Entanglement Between Two Noninteracting Qubits via Interaction with Nonclassical Radiation Field

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(Received: 2004-12-13; Revised:)

Abstract: We study the interaction between a single-mode quantized field and a quantum system composed of two qubits. We suppose that two qubits initially be prepared in the mixed and separable state, and study how entanglement between two qubits arises in the course of evolution according to the Jaynes-Cummings type interaction with nonclassical radiation field. We also investigate the relation between entanglement and purity of qubit subsystem. We show that different photon statistics have different effects on the dynamical behavior of the qubit subsystem. When the qubits are initially prepared in the maximally mixed and separable state, for coherent state field we cannot find entanglement between two qubits; for squeezed state field entanglement between two qubits exists in several short period of time; for even and odd coherent state fields of large photon number, the dynamical behavior of the entanglement between two qubits shows collapse and revival phenomenon. For odd coherent state field of small photon number, the entanglement with both qubits initially prepared in maximally mixed state can be stronger than that with both qubits initially prepared in pure states. For fields of small photon number, the entanglement strongly depends on the states they are initially prepared in. For coherent state field, and odd and even coherent state fields of large photon number, the entanglement only depends on the purity of the initial state of qubit subsystem. We also show that during the evolution the unentangled state may be purer than the entangled state, and the maximum degree of entanglement may not occur at the time when the qubit subsystem is in the purist state.

PACS: 03.65.Ud, 42.50.Dv, 03.67.-a
Key words: entanglement, mixed state, purity, nonclassical state field

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