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Simulation of state transfer from atom to cavity radiation in atom-photon interaction in large detuning

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Abstract

In this research, atom-cavity entanglement in closed Jaynes – Cumming model has been used with the assumption of large detuning between atom and cavity, to simulate the state transfer from atom to cavity radiation. A two-level atom which is prepared in a half-half superposition between the ground and excited states, has been exposed to initially coherent radiation field which is far from resonance with the atom. Mixture of each subsystem, linear entropy, entanglement, Von Neumann entropy and Schmidt decomposition of composite system as a function of time, has been determined analytically, for the first time. Assuming large frequency differences between atom and radiation, the simulation is shown no energy is transferred between atom and radiation due to large detuning, even though atom-radiation entanglement took place. Also, it has been shown that a particular measurement on the atom in this composite entangled system, can project the composite system into a separable (non-entangled) state so that the radiation state is changed into a superposition of the coherent state which is called the cat state. The conditions required to transfer radiation into odd and even cat states have been particularly investigated.

Keywords: state transfer, quantum state engineering, cat states, simulation.

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