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Study of non -classical properties in generalised Jaynes Cummings model

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Abstract: *Mathematical models that permit exact analytic solutions to idealized physical system have been vital to the development of science. The Jaynes-Cummings model (JCM) has a very significant role not only in many theoretical predictions but also in explanation of experiments in cavity-QED. The revival of interest in JCM is due to the observation of many non-classical effects such as collapse-revival phenomena, atom-atom entanglement etc.*

The system of two two-level atoms (TLA) inside a cavity has attracted considerable attention, both because it has become experimentally feasible and because it is paradigm to study the evolution of entanglement.

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In the existing theoretical work a generalized model of standard JCM (Jaynes et al 1963) with two identical two-level atoms that resonantly interact with electromagnetic fields inside the cavity through three-photon three-mode process is studied. Cavity-QED generally deals with a few cavity photons. As such the addition (atomic emission) or annihilation (atomic absorption) effects are expected to change the atom field interaction strength significantly. Hence, the Hamiltonian can also depend on the intensity of the cavity field (s) with which it is interacting and it would be appropriate to extend and study the problems introducing an intensity–dependent coupling constant in the corresponding Hamiltonian. This is what we have considered in our analysis of problems related to cavity-QED.

We consider a model consisting of a lossless cavity through which two two-level atoms pass one after another. The first atom interacts with the cavity field via three photon process and leaves the cavity. The second atom then enters the cavity and interacts with the field with the changes made by its interaction with the first atom. It has been shown earlier that the two atoms get entangled in the process even though they do not interact directly. The properties of the radiation field encountered by them bears crucially on the nature of entanglement.

A unitary transformation method is used to solve the time-dependent problem that also gives the eigensolutions of the interacting Hamiltonian (Singh 2006). The state of the model has been calculated and then the atom –atom entanglement has been analyzed graphically.

Keywords: *Jaynes-Cummings Model, Entanglement, Two-level atom, Hamiltonian, T-Operator, Density Matrix.*