Cavity Qed: a Quantum Trajectory Point of View

Abstract

We study the time evolution of the quantum field inside a cavity coupled to a beam of two-level atoms of temperature T, given that each atom, after having crossed the cavity, interacts with a classical field $\mathcal{E}$ and finally with a detector measuring its state. It is shown numerically that, if the atom-quantum field coupling is weak and $\mathcal{E}$ is large, for any given realization of the measurements, any initial state of the cavity field localizes after some time into a squeezed state. The center α of the squeezed state moves randomly on a line in the complex plane, but the squeezing parameters r and φ show very little fluctuation. Their mean values $\bar{r}$ and $\bar{\varphi}$ are independent of the realization, the initial state, and the atom-field coupling constant. The time evolution of r and φ is computed in the limit of weak atom-field coupling and large $\mathcal{E}$. It is found that $\bar{r}$ increases with T;i.e., the squeezing is enhanced by increasing the temperature of the atomic beam. The limitation on the degree of squeezing that can be reached is discussed.