NON-EQUILIBRIUM STATE OF PHOTON CAVITY PUMPED BY ATOMIC BEAM

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We present a one-atom maser model consisting of a beam of two-level atoms that pass one-by-one through a microwave cavity. The atoms in the beam are excited with probability p. The cavity is modeled by a single photon mode. There is exactly one atom in the cavity at any given time. Our model for interaction corresponds to a non-relativistic QED vertex in the limit of heavy atoms and a soft photon mode. The states of the atoms in the beam remain unaffected by their passage through the cavity. We focus on the asymptotic behavior of the cavity state, doing this in the case of a perfect cavity and in the case of a leaking cavity modeled by adding dissipative term to the generator of the dynamics. We show that in the case of the perfect cavity, the expected number of photons increases indefinitely in time iff $0 < p < 1$. When the leakage is taken into the account, there is a well-defined limiting state of the cavity, which is independent of the initial state. We study this limiting state by computing its characteristic function and show that it is not quasi-free. It is a NESS and we compute the associated energy flow.