Review of: "Dynamics of Three-Level Laser Pumped by Electron Bombardment"

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Potential competing interests: No potential competing interests to declare.

Review of paper entitled “Dynamics of Three-Level Laser Pumped by Electron Bombardment”

The paper is well-organized and well-written. However, there are some shortcomings in the logic that leads to the presented results. Below are some examples:

The interaction Hamiltonian between the atoms and the cavity modes (i.e., Eq. 1) is written for a single atom despite the authors stating in the beginning of Section 2, “*We consider here the case in which N three-level atoms in cascade configuration and available in an open cavity*.” The interaction energy should be the sum of the interaction energies between each atom and the cavity modes.

The master equation (i.e., Eq. 12) does not include cavity dissipation terms. Eq. 10-11 can then be obtained properly from the master equation but in expectation form. The authors work with the expectation values of the atomic operators but avoid to do the same for the cavity operator. There is unnecessary inconsistency here.

Depending on the strength of the interaction, the cavity and atomic operators reach steady state within the same time scale. It is wrong to substitute the steady state values of cavity operators in the time evolution of the atomic operators as is done in Eqs. 29-33. This is not how decouple the expectation values involving products of the cavity and atomic operators.

Another weakness of the paper is that the authors do not comment on the strength g of the interaction. Under weak coupling conditions and assuming that the master equation is correctly set up, decoupling of the expected values of cavity and atomic operators into product of expectations is possible. In the strong coupling regime, decoupling is not possible at all as the cavity and atomic transitions exchange photons many times before decaying.

Based on the above weaknesses, I cannot recommend the publication of the paper in its current form.