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A model of a cavity and a beam of harmonic atoms

H. TAMURA
Institute of Science and Engineering
Kanazawa University

ABSTRACT

We consider a simplified mathematical model for the physical system consists of a cavity and a beam of atoms which pass the cavity successively.

The Hamiltonian contains time-dependent (piecewise constant) term describing interaction between the cavity and the atom in the beam which is passing the cavity at the prescribed moment. We suppose that the radiation field inside the cavity and any atoms of the beam are modeled by simple harmonic oscillators.

We study the time evolution of the density matrix of the system for the initial product state by calculating the expectation values of Weyl operators, explicitly. We discuss about the entropy production of subsystems and the asymptotic behavior of the cavity in a certain scaling limit. In fact, we find the folowing relaxation phenomena of the sub-system arround the cavity:
If the initial state is a product of Gibbs state for the cavity and Gibbs state for the beam with different temperatures, the reduced density matrices of the subsystem converge to the totally Gibbssian density matrix for the initial temperature of the beam.
For more general product initial states, the reduced density matrices of the cavity converge to the Gibbsian density matrix in a certain scaling limit.

This talk is based on the joint work with Prof. V.A. Zagrebnov. The detailed description of the subject is given in the manuscript:

Hiroshi Tamura, Valentin Zagrebnov, *A Dynamics Driven by Repeated Harmonic Perturbations*, http://arxiv.org/arXiv:1404.2998[math.FA]