NON-MARKOVIAN DYNAMICS OF A DRIVEN TWO-STATE SYSTEM

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In quantum optics the precise description of the interaction between atoms and light is of fundamental importance. The theory of open quantum systems addresses the question of decoherence, a phenomenon that arises from the interaction between a system and its environment, e.g. the electromagnetic field surrounding the atoms. In particular, if the environment is structured, the short time-scale dynamics of the system exhibits an interesting non-Markovian behavior due to the exchange of information between the system and the environment.

In this work we consider a two-state system driven by a near-resonant laser in a structured reservoir modelled by infinitely many quantum harmonic oscillators. The dynamics of the two-level system is studied to second order in perturbation theory. The aim is to refine the description of the dynamics in such way to include the first non-Markovian corrections.

The transition from the Markovian description to the non-Markovian one produces richer dynamics, whose physical meaning can be studied by means of Non-Markovian Quantum Jumps method [1]. Our study reveals how the non-Markovian effects are connected to the particular structure of the reservoir and generally we shed light on how driven two-state systems behave in structured reservoirs.