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Ultrastrong coupling, nonselective measurement and quantum Zeno dynamics

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We study the dynamics of an open quantum system linearly coupled to a bosonic reservoir. We show that, in the ultrastrong coupling limit, the system undergoes a nonselective measurement and then evolves unitarily according to an effective Zeno Hamiltonian. This dynamical process is largely independent of the reservoir state. We examine the entanglement breaking effect of the ultrastrong coupling on the system. We also derive the evolution equation for systems in contact with several reservoirs when one coupling is ultrastrong. The effective system dynamics displays a rich structure and, contrarily to the single reservoir case, it is generally non-Markovian. Our approach is based on a Dyson series expansion, in which we can take the ultrastrong limit termwise, and a subsequent resummation of the series. Our derivation is mathematically rigorous and uncomplicated.

Keyword-1

Open quantum system

Keyword-2

Strong coupling

Keyword-3

Zeno effect

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