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Object: PhD thesis title and resume

The focus of my PhD work has been on Open Quantum Systems from two perspectives: on one hand, the study of entanglement generation and evolution in bipartite systems immersed in and interacting with an external bath; on the other, the characterization of the environment's properties through physical quantities of the subsystem embedded within it.

My PhD thesis, *Open Quantum Dynamics and Bipartite Entanglement*, is organized as follows.

In the first chapter, compound systems are briefly described, focusing on bipartite systems; then some separability criteria based on positive not completely positive maps are given; finally, entanglement measures are axiomatically defined, with some examples of important entanglement measures.

In the second chapter, open quantum systems are described: first reversible and irreversible dynamics are defined; then the reduced dynamics of a system immersed in and interacting with a bath and the master equation are derived, explaining the main Markovian approximations in some detail. Finally the asymptotic states of the dynamics are derived, with particular attention to the one- and two-qubit cases, which are of interest for this thesis.

The third chapter is dedicated to the determination of the phenomenological parameters of the master equation in a particular one-dimensional open quantum system. This system consists of a wire with one spin-1/2 impurity embedded in it and interacting magnetically with an electron that can propagate through the same wire. The whole system is immersed in an external bath whose dissipative and noisy effects act only on the spin-1/2 impurity. For this system an explicit expression of the environment's noise parameters is found in terms of the electron's transmission and reflection probabilities, which can be measured.

In the fourth chapter, the behavior of entanglement in open quantum systems is described: in particular, a two-qubit system is studied, analyzing both entanglement generation through the environment and its evolution under Markovian dynamics with the possibility of its asymptotic persistence.

Finally, the last two chapters deal with explicit examples of the behavior of entanglement in open quantum systems, Chapter 5 concerning entanglement generation and Chapter 6 describing entanglement evolution and comparing it to the behavior of entropy.
In the former, a bipartite system of two qubits immersed in a common external bath with which they weakly interact (without directly interacting between each other) is considered: a necessary and sufficient condition for entanglement generation between the two qubits only via the bath-mediated interaction is found. This condition is further generalized to a sufficient condition for environment-induced entanglement generation in a bipartite system of arbitrary dimension.
In the latter, a bipartite system of two qubits immersed in a common external bath undergoing a particular dissipative evolution is considered. Inspired by a previous work where it was conjectured that the change of entanglement in time (entanglement rate) is always bounded by the change of entropy in time (entropy rate) for non-driven open quantum systems, the entanglement and entropy rates for our particular dissipative dynamics are studied. Varying the initial states and the noise parameters of our dissipative evolution, the behavior of entanglement is analyzed in this system and the entanglement and entropy rates are compared. In particular, it is found that the above conjecture is verified if the asymptotic state of the dynamics is separable, whereas it is violated if the asymptotic state is entangled.