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Non-Markovian effects at the quantum speed limits

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In this work, we seek to understand the evolutive dynamics of general quantum systems. For that, the quantum system is described as an open quantum system, that is, a physical system that can interact with the environment. Such evolutive dynamics can be represented, in general (for both open and closed systems), with the formalism of quantum channels, i.e: we get a mapping of density operators onto density operators that describe the evolution of the system's state for every time " $t \geq 0$ ". Moreover, it's possible to get a description in terms of Master Equations, in which the evolution of the system is given in terms of a differential equation involving the density operator. As a result, such evolutions may have a "memory effect", where the state in a posterior time can depend on states from anterior times. These dynamics are called "Non-Markovian Dynamics". In general, dynamics of open quantum systems are usually non-Markovian. However, for a range of interesting physical systems, such memory effects can be neglected and the state in a time t does not depend on the states from anterior times $t' < t$. By this approximation, the dynamic of the system is called "Markovian Dynamic". Another important feature of evolutive dynamics of quantum systems is called Quantum Speed Limit. The Quantum Speed Limit (QSL) is the time lower bound for a given initial state to evolve to another state. Actually, recent results have shown that there is no general connection between the quantum speed limit and non-Markovianity. (1) Moreover, recent works also propose that non-Markovianity can be used to decrease the QSL between two quantum states. Therefore, the objective of this work is to understand how non-Markovian dynamics can affect the Quantum speed limit between two quantum states, which is an open problem yet, and also to understand how the divisibility of the Dynamical Map can affect the QSL.

Palavras-chave: Quantum information. Quantum speed limit. Non-Markovian quantum dynamics.

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