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SIFSC 11

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Energetics of autonomous quantum systems

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Quantum thermodynamics (QT) is the research field concerned both with the extension of thermodynamics to small non-equilibrium quantum systems (top-down) and the emergence of these macroscopic laws from underlying quantum dynamical ones (bottom-up). Historicaly, QT is the most natural result of recent successful efforts to expand the applicability range of thermodynamics and, despite its youth, is already a very promising and fruitful field for both theoretical and practical purposes. Its importance becomes obvious when technological progress enable us to design and develop devices capable to function in scenarios where quantum effects are relevant and – potentially – necessary to their operation. In this sense, a thermodynamic description of such genuine quantum technologies is imperative in order to properly understand and fabricate them. However, even though the constant growing community, efforts and published papers on the field, there are several subtle and basic questions to be addressed. In particular, despite different proposals (1-3), it still not clear how to properly define and establish coherent quantum version of classical thermodynamic concepts and quantities, such as work, heat and even internal energy. Such critical gap intensifies when one deals with open quantum systems beyond the usual approximated regimes and orthodoxal thermodynamic setups, especially in contexts where strong-coupling and correlations are extremely important to the local dynamical descriptions. Here, we are interested to address such fundamental questions, in particular we are concerned on the energetics of generic quantum systems. In order to do that we propose and introduce a new general framework applicable to the thermodynamic analysis of arbitrary autonomous dynamics.

Palavras-chave: Quantum mechanics. Quantum thermodynamics. Open quantum systems

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201