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Can quantum correlations be verified as physical resources in quantum processes?

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The extension of concepts such as internal energy, heat, work and reversibility towards the realm of genuinely quantum systems far from equilibrium is a major quest in contemporary physics. In particular, searching for a concrete connection between quantum correlations and energy exchanges is, from the point of view of newly-emerging quantum technologies, a central task from which one might expect both advantageous and undesirable outcomes. In a recent communication, for instance, experimentalists claimed to have verified that a quantum engine working in a coherent superposition can achieve a higher power than its classical counterpart. (1) Meanwhile, a theoretical approach recently devised by our group addressed a consistent definition of internal energy change, as well as its decomposition into work and heat, for a fully quantum, autonomous-universe model system - namely, a qubit under exchange interaction with a one-photon electromagnetic pulse. (2) Later on, we found theoretical support for the generalization of this approach onto the case of a qubit under virtually arbitrary conditions, also determining a simple relation between work and coherences for such a general framework. (3) It is in this context and on these grounds that we wish to address the question featuring in the title of this project. By probing our formalism in a larger number of specific model systems, we expect to find a path towards establishing thermodynamical relations in an increasingly general context, hopefully so as to sustain the methods and definitions adopted thus far - later seeking to extend them to systems of larger dimensionality as well. Furthermore, in the course of this research, we intend to address an inquiry also on the (eventual) role played by statistical fluctuations in the relation between correlations and thermodynamic quantities, which may constitute an important complementary approach to the one being currently worked on by us. In short, we hope to be able to shed light on the role of "quantumness" to the energetic balance, testing as thoroughly as possible those that have been our basic theoretical hallmarks: a totally quantum-mechanical description of interactions, and an intrinsically dynamical notion of energy.

Palavras-chave: Quantum thermodynamics. Open quantum systems. Thermodynamics of information.

Referências:

1 KLATZOW, J. *et al*. Experimental demonstration of quantum effects in the operation of microscopic heat engines. **Physical Review Letters**, v. 122, n. 11, p. 110601-1-110601-6, Mar. 2019.
2 VALENTE, D.; BRITO, F.; FERREIRA, R.; WERLANG, T. Work on a quantum dipole by a single-photon pulse. **Optics Letters**, v. 43, n. 11, p. 2644-2647, June 2018.
3 NEVES, L. R. T. **Quantum thermodynamical work beyond the Markovian limit**. Advisor: Frederico Borges de Brito. 2020. 23 p. Course conclusion assignment (Physics Undergraduate Program) - São Carlos Institute of Physics, University of São Paulo, São Carlos, 2020.