



Contribution ID: 94

Type: not specified

Reliable quantum advantage in quantum battery charging precision

What is a quantum battery? Actually, it is not an ‘everyday-life battery’ that exploits some quantum features. Rather, we can call ‘quantum battery’ any quantum object capable of storing energy and delivering it when needed. However, such energy can be subjected to non-negligible fluctuations. This represents a remarkable problem: quantum computers, for instance, need a high level of precision to carry out computations, and thus energy fluctuations must be finely controlled.

Here, we show how Quantum Thermodynamics provides several tools to analyze, model, and predict the effects of energy fluctuations in quantum systems. To do so, we employ a quantum battery as a test-bed device: while injecting energy into a qubit (the battery), we monitor the energy exchanges between the qubit and a quantum oscillator. The exploitation of genuine quantum features, together with the analysis of the system energetics, allows us to render the entire process extremely efficient and precise.

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Session Classification: Caffè e poster (dal N. 9 al N. 51)