International Conference on Quantum Energy 2025 hosted by Dipartimento di Fisica e Astronomia Galileo Galilei an event by ICQE

Contribution ID: **43** Type: **Oral presentation**

Frustrating quantum batteries

Friday 6 June 2025 15:10 (20 minutes)

We are at the verge of the Quantum Technology Revolution: quantum mechanics allows for phenomena that have no classical counterparts and which can be harvested for new technologies. An example of the emerging quantum technologies are quantum batteries (QB), i.e. quantum mechanical systems that can store and transfer energy in a coherent way. While the practical implementation of such devices is still far from becoming reality, a serious effort is being devoted to understanding their advantages and limitations, using different platforms and protocols. As it has been recently demonstrated that the introduction of topological frustration in one-dimensional spin-1/2 chains can strongly modify the low energy properties of these systems, we investigate the performance of a quantum battery realized through such frustrated chains and show their superiority compared to their unfrustrated counterpart in terms of both energy storage and transfer. We quantify this superiority using the notion of ergotropy, that is, the maximum amount of work that can be extracted from a quantum system with a unitary transformation.

Theme

Theme 2. Quantum effects in energy processes and materials

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Track Classification: Theme 2. Quantum effects in energy processes and materials