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Dissipative Quantum Chaos Perspective on Near-Term Quantum Computing

Shifting the paradigm of near-term quantum processors and algorithms based on recent ideas on the physics of open quantum systems, quantum chaos and dissipative quantum dynamics.

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Consortium

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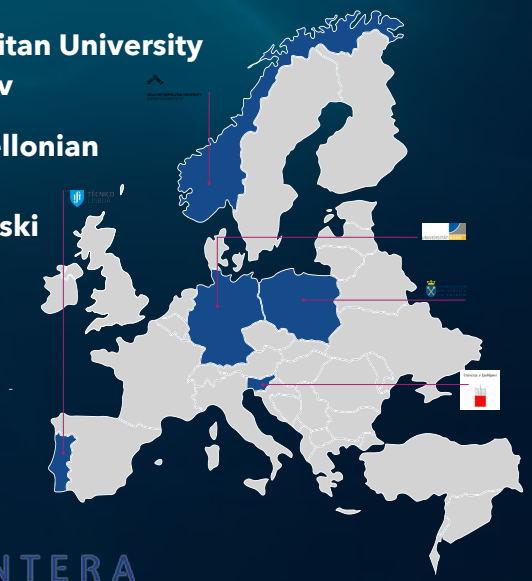

QUANTERA

The arrival of Quantum Computer (QC) prototypes developed by companies like D-Wave Systems, Honeywell, Google, and IBM, marked the beginning of the era of Quantum Information Technology. Yet, after almost a decade, the available platforms remain prototypical. The reason for this is rooted in physics: It is extremely difficult to isolate quantum processors from their environment while keeping the necessary degree of control.

Rather than contributing to the ongoing fight with environment-induced decoherence, we want to shift the paradigm and develop an approach that uses dissipation as a resource. We will accomplish this by reviewing quantum processors, quantum algorithms, and quantum error correction schemes from the perspective of Dissipative Quantum Chaos.

The primary objective of our project is to develop a theory of dissipative quantum circuits, based on recent ideas on the physics of open quantum systems. The theory will provide a new approach to analysis and design of qubit-based circuits in the current era of Noisy Intermediate-Scale Quantum Technologies.

On the way to this goal, we will develop a methodology of simulations of open quantum systems on the existing QC prototypes. This will constitute a new approach to experimental studies of open quantum many-body systems and highlight the present-day QCs as already established flexible platforms to explore, simulate, and model complex systems and phenomena.