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## A quantum of noise: Recent progress on dissipative quantum computation and simulation

Abstract: Quantum information processing is to a large extent performed using unitary gate operations. These are affected by decoherence and dissipation which imposes limitations on realizable quantum information tasks. The alternate strategy of engineering dissipation to play an active role in quantum information protocols [1] has developed into a new paradigm which enriches the toolbox of quantum computing and quantum simulation [2] and holds promise to overcome problems with the unitary approach [3].

More recently, engineered dissipation has been employed for quantum error correction. I will present an autonomous quantum error correction scheme that harnesses dissipation to stabilize a qubit [4]. The protocol can be implemented in systems of trapped ions and allows for an improvement of the sensitivity of a quantum measurement.

A second line of research is comprised by the study of many-body phenomena of fundamental interest that are triggered by dissipation. I will discuss a non-equilibrium phase transition in the open-system Dicke spin-boson model that occurs in addition to the well-known superradiant phase transition [5].

These advancements open the door to high-fidelity protocols for dissipative quantum computing and to integrating dissipation into algorithms for noisy intermediate-size quantum (NISQ) devices.

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