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Quantum Stochastic Thermodynamics

Classical stochastic thermodynamics shows us how to extend the definitions of basic thermodynamic quantities (such as internal energy, heat, work, or entropy) to single stochastic trajectories of small systems far away from equilibrium. A proper quantum generalization of these concepts is subtle, as it is not really clear what a ‘stochastic trajectory’ should be. After reviewing some previous approaches, I will propose definitions for internal energy, heat, work and entropy, which are based on a recently developed rigorous notion of a quantum stochastic process. These definitions fulfill a first and second law for an arbitrary set of external interventions. An application to recent experiments is given.