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Thermodynamics experiments on single-electron circuits and superconducting qubits

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Thermodynamics of quantum systems and processes has attracted increased attention in the past years due to the fundamental interest in physics of small systems and the possibilities provided by advanced fabrication and measurement techniques. In particular time-resolved detection of single electrons and the possibility to directly measure heat via sensitive and fast thermometry in low temperature nanostructures have opened a new avenue in stochastic thermodynamics. Advances in superconducting qubit research provide further new opportunities in quantum thermodynamics. Here I review our experiments on non-equilibrium fluctuation relations, on externally controlled and autonomous Maxwells demons and our first steps in using superconducting qubits as working substance in quantum heat engines and refrigerators.