Thermodynamic cost of finite-time (recurrent) erasure

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Information is a physical quantity and it costs work to erase it.

The seminal results of Landauer from 65 years back, showed that the least possible cost for erasing one bit of information can be achieved when the erasure process is carried out very slowly, so that the system starts in equilibrium and always remains in equilibrium during the entire process. However for any practical implementation, the erasure process needs to take a finite amount of time. It is not guaranteed that the initial state is in equilibrium either. What is then the work cost of erasing information under such conditions? For Markovian processes, many results are known in the context of the so-called "finite-time Landauer erasure principle". Two optimization problems that are typically studied in this context are: 1) Designing optimal protocols that transition between two specified distributions within finite time and 2) designing optimum protocols that minimize the cost needed to shift between two different potential energy landscapes, often harmonic, in finite time. In both cases this optimization problem can be used to place very general bounds on the least amount of work cost necessary to implement information erasure in finite time.

In this talk I will talk about some results (including our own) in this topic.