Final report visit C. Van den Broeck with S. Cilberto ENS Lyon

Work distribution and efficiency at maximum work for information processing.

As mentioned in the funding request, the 6 day visit consisted in 2 separate 3 day visits with the following dates : 13.01-15.01. 2013 28.02-02.02.2013

Purpose

The purpose of the visit was to investigate the possibility for the experimental verification of integral and detailed fluctuation theorem for information processing and to explore a number of other issues such as coding and efficiency at maximum work.

Description of work

The first main activity consisted in a in depth visit of the laboratory with a detailed discussion of advantages and disadvantages of the various experimental set-ups (Ciliberto Petrosyan).

The theoretical discussions with Ciliberto and his student covered the fluctuation theorem for filtered trajectories, the issues of reversible computation, the question of coding and dissipation, the application of finite time thermodynamics to information processing, and finally the possibility of using stochastic thermodynamics in distributed memory devices.

We had several discussions with Krzystoff Gadwedzki, about fluctuation theorems (theoretical aspects and didactic presentation), optimization in finite time thermodynamics, and synchronization of active oscillators.

Main result

The main result is the verification of the integral fluctuation theorem upon erasure of one bit and the transition of this result into the usual Jarzynski equality. Unfortunately , the verification of a Crooks type of relation is for technical reasons not easy to perform experimentally

(the inverse process is difficult to implement in a controllable fashion), but it could of course be verified in numerical simulations.

Future Collaboration

We anticipate future collaboration on the finite time thermodynamics of information processing. Indeed the bounds that are imposed by for example the generalized Jarzynski equality (valid for transition between nonequilibrium states) have the subtlety that the equality can in general not be achieved for very slow adiabatic processes. We have proposed that this issue could be experimentally and numerically investigated.

Projected publication

One paper is in preparation in which the integral fluctuation theorem upon erasure of one bit and the transition of this result into the usual Jarzynski equality is presented. Since our contribution on this issue was and will, as far as the manuscript is concerned, be mostly advisory, we proposed not to be coauthor but there will be an acknowledgment including the ESF sponsoring of my visit.