

Scientific Report

The main purpose of the visit was to initiate joint research on stochastic thermodynamics, with as initiating theme the case of Kangaroo stochastic processes. The visit was exceptionally productive. We cite briefly what has been achieved.

1. We could estimate the large deviation properties of Kangaroo processes driven by 1 or 2 different processes. We discuss two applications : a more mathematical application, dealing with the number of zero crossings of one of the processes while the other process corresponds to a resetting, and one from stochastic thermodynamics, with the evaluation of the stochastic heat flux and the verification of the fluctuation theorem for a system in contact with two heat baths.
2. We apply similar ideas to the case of a kinetic equation for a particle with a collision process described by Kangaroo dynamics. The fluctuation theorem is again verified.
3. We performed simulations for a kinetic Ising model consisting of a linear chain of spins, in contact with two reservoirs at different temperature. The fluctuation theorem is verified. The model itself is new in the context of stochastic thermodynamics as some of the transitions are of the micro-canonical type. More precisely, the center section of the spin chain obeys micro-canonical dynamics in the sense that spin flips are only allowed if they do not cost energy. The analytic investigation of the minimal model (3 spins with 2 boundary spins and one spin in the center) is under way.

We are working on 3 manuscripts in which these results will be reported with acknowledgment to the EPSD network of the ESF. One deals with the large deviation theory for Kangaroo processes. A second discusses stochastic thermodynamics for kinetic models with Kangaroo type of collision process. The third paper explores the heat conduction and entropy production for a linear chain of Ising spins, connected at its end sites to reservoirs at different temperature, with stochastic microcanonical dynamics on the other sites.

EPSD short visit of C. Van den Broeck with R. Toral

09-23 November 2013

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Others visits are planned to continue the collaboration, more precisely a short visit by R. Toral to C. Van den Broeck end February 2014, and a 3 week visiting professor appointment for C. Van den Broeck end of 2014.