Efficiency fluctuations in small machines

Gatien Verley

gatien.verley@gmail.com

Université d'Orsay, France

Small systems like quantum dots, molecular motors, colloids or DNA hairpins manipulated by optical tweezers have been used to analyze the fluctuations of thermodynamic quantities defined at the trajectory level. Work and heat exchanges or entropy production can now be sampled for various realizations of the same experiment. The theoretical works in the field study the probability distributions of these thermodynamic quantities and their symmetry properties that can be discussed even far-from-equilibrium. Such symmetries, called fluctuations theorems, formulate at the probabilistic level strong constraints like the second law of thermodynamics. After a brief review of the main achievements in the field, I will introduce the notion of efficiency fluctuations in small machines. I will present the consequences of the fluctuation theorems on the efficiency fluctuations, both in the far-from-equilibrium regime and in the close-to-equilibrium regime. I will also discuss the efficiency fluctuations at finite time or in the limit of tightly coupled input and output fluxes.

[1] G. Verley, M. Esposito, T. Willaert and C. Van den Broeck, "The unlikely Carnot efficiency", to appear in Nature Communications, Arxiv [1404.3095].