Computational method of Large Deviation functions using phenomenological structure in thermodynamic formalism

Takahiro Nemoto*[1]

[1]Laboratoire de Physique – École Normale Supérieure (ENS) - Lyon – France

Abstract

Thermodynamic functions provide quantitative relations among macroscopic observables in equilibrium systems. These functions are constructed by operational (or phenomenological) manners within the theory of thermodynamics. On the other side, from the statistical mechanics, which connects the thermodynamic functions to microscopic theories such as Newtonian dynamics, one has known that the thermodynamic functions also play a role of the large deviation functions of thermodynamic variables. This structure is suggestive, and recently, several results, for extending this structure to the large deviation functions of time-averaged quantities in non-equilibrium systems, have been developed. In time-series statistics, the large deviation functions are connected to the frequency of rare events. Then, what follows from the phenomenology similar to thermodynamics for constructing these large deviation functions within an operational manner, if it exists? On one hand, the large deviation functions are phenomenologically obtained. On the other hand, it describes the frequency of rare events characterized by large deviation principle. Such a phenomenology should become a rare event sampling method that can be used in real experiments. In this talk, I am going to propose a computational method of large deviation functions of time-averaged quantity [T. N. and S. Sasa, Phys. Rev. Lett. 112, 090602 (2014)], which is based on this idea. We apply the method to numerical studies of non-equilibrium lattice gases, and show some non-trivial features about rare events behind those models.

*Speaker