Contribution ID: **2**

Type: **not specified**

Faster than Nature: Engineered swift equilibration of small systems.

Friday, 25 October 2019 08:30 (35 minutes)

A fundamental and intrinsic property of any device or natural system is its relaxation time \tau_{\rm relax}, which is the time it takes to return to equilibrium after the sudden change of a control parameter. Reducing \tau_{\rm relax} is frequently necessary, and is often obtained by a complex feedback process. To overcome the limitations of such an approach, alternative methods based on suitable driving protocols have been recently demonstrated, for isolated quantum and classical systems. Their extension to open systems in contact with a thermostat is a stumbling block for applications. Here, we design a family of protocols, named Engineered Swift Equilibration (ESE), that shortcuts time-consuming relaxations. We apply them to a Brownian particle trapped in an optical potential and to the cantilever of an Atomic Force Microscope, which are paramount tools to measure forces of femtoNewtons with microsecond accuracy. We implement the process experimentally, showing that it allows the system to reach equilibrium several order of magnitude of time faster than the natural equilibration rate (from miliseconds to microseconds). We also measure the increase of the dissipated energy needed to get such a time reduction. The method paves the way for applications in micro- and nano-devices, where the reduction of operation time represents as substantial a challenge as miniaturization.

Primary author: Dr MARTÍNEZ, Ignacio A. (Universidad Complutense de Madrid)

Presenter: Dr MARTÍNEZ, Ignacio A. (Universidad Complutense de Madrid)

Session Classification: Thermal noise in and out of thermodynamic equilibrium