

Stochastic Thermodynamics: An Emerging, Evolving Field

Edgar ROLDAN (ICTP)

This talk will review the theoretical formalism and some experimental achievements in stochastic thermodynamics, an emerging field that describes the fluctuating nature of the thermodynamic fluxes at the mesoscopic scale. First, I will present the foundations of the field including: (i) the formulation of first and second laws for discrete and continuous nonequilibrium stochastic processes; (ii) fluctuation theorems which provide universal relations for the statistics of the entropy production and work associated with single stochastic trajectories; (iii) extension of the thermodynamic laws to systems with feedback control (e.g. Maxwell's demons); (iv) key experimental verifications of fluctuation theorems with optical tweezers and electronic systems.

Next, the talk will serve an appetizer over two refreshing approaches developed over the last lustrum: the thermodynamic uncertainty relations and the martingale theory of stochastic thermodynamics. I will briefly discuss which type of new universal thermodynamic properties can be accessed using martingales in non-equilibrium thermodynamics and possible connections with finance.