Entropy production and its model-free inference

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Entropy production is a central and broadly applicable measure of nonequilibrium behavior in systems coupled to a heat bath, including driven soft and active matter and bio-molecular systems. Despite its fundamental role, both the theoretical identification and experimental inference of entropy production remain challenging, largely because many contributing degrees of freedom are experimentally inaccessible. This raises the key question of how entropy production can be consistently identified and inferred from coarse-grained models and observations [1].

I will show how model-free lower bounds on entropy production can be obtained from the observation of currents via the thermodynamic uncertainty relation, demonstrated with experimental data on the molecular motor kinesin [2]. Tighter bounds and a thermodynamically consistent identification of entropy production along individual coarse-grained trajectories are achieved using waiting-time distributions together with the concepts of Markovian events and Markovian snippets [3,4]. As an application, I present results from experimental data on the unfolding of a small peptide [5].

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