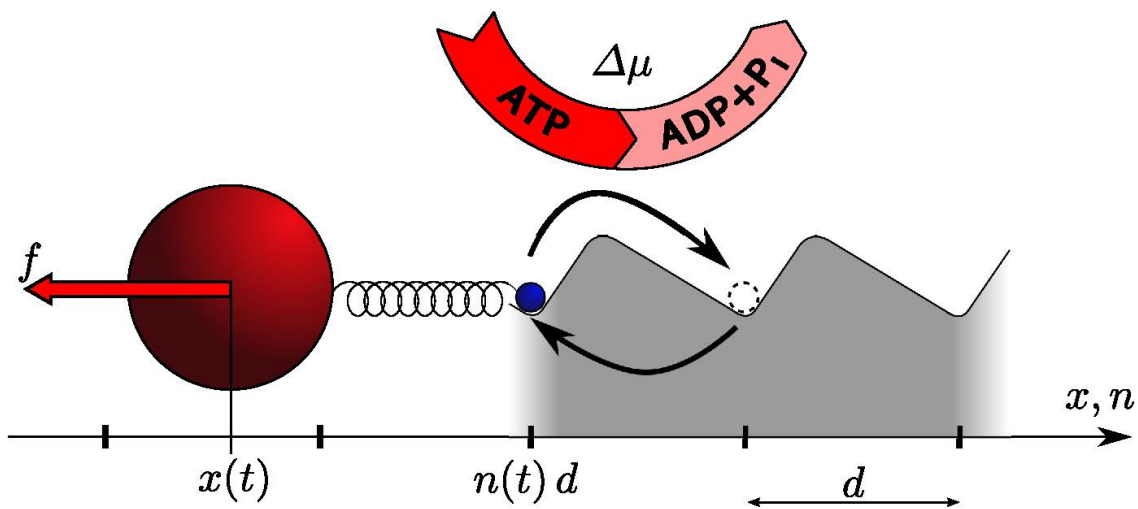




# PHYSIKALISCHES KOLLOQUIUM

AM 10. JUNI 2024 UM 17 UHR C.T.  
IM GROßEN HÖRSAAL



## STOCHASTIC THERMODYNAMICS: FROM CONCEPTS TO MODE-FREE INFERENCE

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Stochastic thermodynamics provides a universal framework for analysing nano- and micro-sized non-equilibrium systems. Prominent examples are single molecules, molecular machines, colloidal particles in time-dependent laser traps and biochemical networks. Thermodynamic notions like work, heat and entropy can be identified on the level of individual fluctuating trajectories. They obey universal relations like the fluctuation theorem.

Thermodynamic inference as a general strategy uses consistency constraints derived from stochastic thermodynamics to infer otherwise hidden properties of non-equilibrium systems. As a paradigm for thermodynamic inference, the thermodynamic uncertainty relation discovered in 2015 provides a lower bound on the entropy production through measurements of the dispersion of any current in the system. Likewise, it quantifies the cost of temporal precision for biomolecular processes and provides a model-free bound on the

thermodynamic efficiency of molecular motors and microscopic heat engines. Generalizations allow us to apply it to time-dependently driven systems like the unfolding of proteins under mechanical force. Waiting time distributions between observable events yield even better bounds on entropy production and the topology and driving affinity of the underlying network.

In this talk, I will introduce the main concepts and illustrate them with representative examples.

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