Contribution ID: **32** Type: **Long Talk**

Stochastic thermodynamics for classical non-Markov jump processes based on the Fourier embedding

Thursday, 11 December 2025 14:20 (50 minutes)

Stochastic thermodynamics explores the thermodynamic structure of small systems based on stochastic processes. However, conventional stochastic thermodynamics has relied on the Markov assumption—the assumption that the system's history dependence is negligible—except for a few specific non-Markov models. Since many real physical phenomena have history dependence, it is important to develop stochastic thermodynamics for more general non-Markov processes with memory effects. In this talk, we present stochastic thermodynamics for non-Markov jump processes. We develop the Fourier embedding and derive the master equation for general non-Markov jump processes as a new tool to formulate the time-reversal symmetry. We show the first and second laws for non-Markov jump processes. Finally, we present two new non-Markov models that can be investigated by our framework from thermodynamic viewpoints.

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Session Classification: Thursday