The geometry of nonequilibrium response

Sean Fancher and Jordan Horowitz

University of Michigan, 930 N. University, Ann Arbor, 48109, USA

Near thermodynamic equilibrium, the fluctuation-dissipation theorem serves as an organizing principle and calculational tool for analyzing a system's sensitivity to external perturbations by linking response to fluctuations. However, driving a system out of equilibrium can enhance this sensitivity by breaking the traditional connection to fluctuations. In this talk, I will present bounds on the maximum response achievable by nonequilibrium systems that can be modeled as discrete-state Markov processes. The limits are determined by the network topology of the system's state space. As a result of this analysis a full description of the geometry of nonequilibrium response emerges, offering a decomposition of any nonequilibrium response in terms of a combination of optimal archetypal systems.

This projected is supported in part by the National Science Foundation under Grant No. 2142466 and by the Alfred P. Sloan Foundation under grant G-2022-19440.