# Efficient Path Sampling of Ising Dynamics for Identifying Low-Dissipation Protocols

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## Abstract

Importance sampling of trajectories has proved a successful strategy for exploring rare dynamical behaviors of complex systems in an unbiased way. Carrying out this sampling, however, requires an ability to propose changes to dynamical pathways that are substantial, yet sufficiently modest to obtain reasonable acceptance rates. Satisfying this requirement becomes very challenging in the case of long trajectories, due to the characteristic divergences of chaotic dynamics. A promising strategy guides a trial trajectory by manipulating the sequence of random numbers that advance its stochastic time evolution. In cases where this "noise guidance" synchronizes trajectories effectively, as the Glauber dynamics of a two-dimensional Ising model, we show that efficient path sampling can be achieved for even very long trajectories. We use this path sampling to explore an ensemble of driving protocols which induce a spin-inversion in finite time with low dissipation.
This is joint work with Phill Geissler, Grant Rotskoff, and Gavin Crooks.

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