

Abstract Submitted
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Replica and extreme-value analysis of the Jarzynski free-energy estimator MATTEO PALASSINI, FELIX RITORT, Department of Fundamental Physics, University of Barcelona — We analyze the Jarzynski estimator of free-energy differences from nonequilibrium work measurements. By a simple mapping onto Derrida's Random Energy Model, we obtain a scaling limit for the expectation of the bias of the estimator. We then derive analytical approximations in three different regimes of the scaling parameter $x = \log(N)/W$, where N is the number of measurements and W the mean dissipated work. Our approach is valid for a generic distribution of the dissipated work, and is based on a replica symmetry breaking scheme for $x \ll 1$, the asymptotic theory of extreme value statistics for $x \gg 1$, and a direct approach for x near one. The combination of the three analytic approximations describes well Monte Carlo data for the expectation value of the estimator, for a wide range of values of N , from $N=1$ to large N , and for different work distributions. Based on these results, we introduce improved free-energy estimators and discuss the application to the analysis of experimental data.

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