Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Jarzynski equality for spin glasses and its application MASAYUKI OHZEKI, Department of Systems Science, Graduate school of Informatics, Kyoto University, KOJI HUKUSHIMA, Department of Basic Science, Graduate School of Arts and Sciences University of Tokyo, HIDETOSHI NISHIMORI, Department of Physics, Tokyo Institute of Technology — We study an application of Jarzynski equality to spin glasses with gauge symmetry. It is shown that the exponentiated free-energy difference appearing in the Jarzynski equality reduces to a simple analytic function written explicitly in terms of the initial and final temperatures if the temperature satisfies a certain condition related to gauge symmetry. This result can be used to derive a lower bound on the performed work during the nonequilibrium process by changing the external magnetic field as well as a pseudo work done during changing temperature. The latter case serves as useful information to implement the population annealing developed in numerical use of the Jarzynski equality to equilibrate the many-body system. We also prove several exact identities that relate equilibrium and nonequilibrium quantities. These identities show possibility of the population annealing to evaluate equilibrium quantities from nonequilibrium computations, which may be useful for avoiding the problem of slow relaxation in spin glasses.

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Date submitted: 11 Nov 2011 Electronic form version 1.4