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Nontrivial nonequilibrium critical relaxation in cluster algorithms and universal nonequilibrium-to-equilibrium scaling procedure YOSHIHIKO NONOMURA, Computational Materials Science Unit, National Institute for Materials Science, Tsukuba, Ibaraki 305-0044, Japan, YUSUKE TOMITA, College of Engineering, Shibaura Institute of Technology, Saitama 337-8570, Japan — Recently we have found that the nonequilibrium relaxation from the perfectly-ordered state of the 2D and 3D Ising models in cluster algorithms shows nontrivial stretched-exponential decay at the transition temperature. Similar nontrivial nonequilibrium critical relaxation is also observed in the 2D XY, 3D XY and 3D Heisenberg models; simple exponential decay in these cases. In order to confirm these behaviors and evaluate the scaling form precisely and robustly, we have proposed a universal scaling procedure to connect nonequilibrium and equilibrium behaviors continuously. For example, when the critical relaxation of the average magnetization $\langle m(t)\rangle$ of a system with linear size L is observed in local-update algorithms, this quantity decays in a power law in the early-stage relaxation with $\langle m(t)\rangle \sim t^{-\beta/(z\nu)}$ and converges to the critical magnetization $m_{\rm c}(L) \sim L^{-\beta/\nu}$ in equilibrium. Then, when $\langle m(t)\rangle L^{\beta/\nu}$ is plotted versus tL^{-z}, data for various system sizes are scaled on a single curve in the whole parameter region. This procedure also holds for the cases with cluster algorithms.

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