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Non-equilibrium relaxation analysis in cluster algorithms YOSHIHIKO NONOMURA, Computational Materials Science Unit, National Institute for Materials Science, Tsukuba, Ibaraki 305-0047, Japan — In Monte Carlo study of phase transitions, the critical slowing down has been a serious problem. In order to overcome this difficulty, two kinds of approaches have been proposed. One is the cluster algorithms, where global update scheme based on a percolation theory is introduced in order to refrain from the power-law behavior at the critical point. Another is the non-equilibrium relaxation method, where the power-law critical relaxation process is analyzed by the dynamical scaling theory in order to refrain from time-consuming equilibration. Then, the next step is to fuse these two approaches — to investigate phase transitions with early-stage relaxation process of cluster algorithms. Since the dynamical scaling theory does not hold in cluster algorithms in principle, such attempt had been considered impossible. In the present talk we show that such fusion is actually possible using an empirical scaling form obtained from the 2D Ising models instead of the dynamical scaling theory. Applications to the $q \geq 3$ Potts models, $\pm J$ Ising models *etc.* will also be explained in the presentation.

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