Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

**Critical nonequilibrium relaxation in cluster algorithms in the BKT and weak first-order phase transitions** YOSHIHIKO NONOMURA, Computational Materials Science Unit, National Institute for Materials Science (NIMS), Tsukuba, Ibaraki 305-0044, Japan, YUSUKE TOMITA, College of Engineering, Shibaura Institute of Technology, Saitama 337-8570, Japan — Recently we showed that the critical nonequilibrium relaxation in cluster algorithms is widely described by the stretched-exponential decay of physical quantities in the Ising [1] or Heisenberg [2] models. Here we make a similar analysis in the Berezinsky-Kosterlitz-Thouless (BKT) phase transition in the 2D XY model (simple exponential decay) and in the weak first-order phase transition in the 2D $q = 5$ Potts model (power-law decay) [3], which means that these phase transitions can clearly be characterized by the present analysis. These relaxation behaviors are compared with those in the 3D and 4D XY models (second-order phase transition) and in the 2D $q$-state Potts models ($2 \leq q \leq 4$ for second-order and $q \geq 6$ for strong first-order phase transitions.

[1] Y. Nonomura, J. Phys. Soc. Jpn. **83**, 113001 (2014); [2] Y. Nonomura and Y. Tomita, arXiv:1508.05218; [3] Y. Nonomura and Y. Tomita, arXiv:1509.08352.

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Date submitted: 05 Nov 2015 Electronic form version 1.4