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# Phase transition of modified XY model under external shear field

Masamichi J. Miyama miyama@wpi-aimr.tohoku.ac.jp
WPI-AIMR, Tohoku University

We already know some examples that a system exhibits the different behavior at its critical point under weak non-equilibrium external field from that under an equilibrium condition. Recently, in our previous study, we have found that colloidal suspensions under shear flow exhibits the critical slowing down near its melting point, and it indicates the exisitence of the change of the order of the order-disiorder phase transition from the first order (discontinuous) transition under equilibrium conditions to the second order like (continuous) one [mjm, S. Sasa, Phys. Rev. E 83, 020401(R) (2011)].

In order to understand that these phenomena is univarsal or not, we consider the simple lattice model which exhibits the first order transition. Concretely, we analyze the modified XY model whose interaction potential is represented as $U(\theta_i - \theta_j) = 1 - [(1 + \cos(\theta_i - \theta_j))/2]^p$. For the original XY model, $p$ equals the unity. In this model, the existence of the first order transition for enough large $p$ is rigorously proved [van Enter et al, Phys. Rev. Lett. 89, 285702 (2002).]. For this model, we introduce the external shear field (spin rotating force), and we observe the steady-state property and its melting dynamics.

In this poster presentation, we report the two results: First, with applying external shear field, the mosaic like pattern of phase configurations in ordered phase, which is not observed under equilibrium conditions as shown in the figure below. Second, we have confirmed that the system under external shear field exhibits the critical slowing down in the melting process.

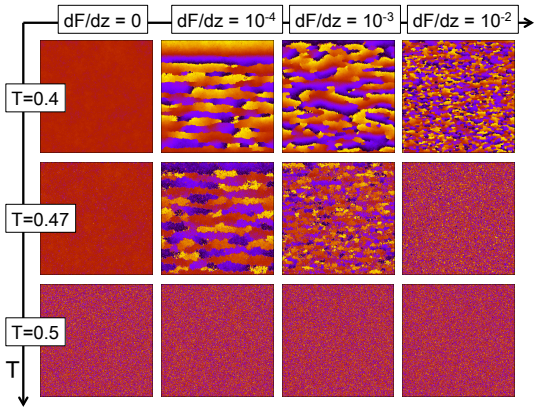


図 1: Typical samples of phase configuration of modified XY model in two dimesional square lattice ($L = 1024$).