Phase ordering and symmetries of the Potts model

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We have studied the ordering of the dynamic q-colours Potts model in two dimensions [2]. It was shown by De Oliveira et al. [3] that when quenching the system from a disordered state to zero temperature, and provided that the thermodynamic limit is taken before the infinite-time limit, the system converges towards a non-equilibrium phase with positive energy for $q > 4$, and it never achieves the ground state in this q-range. We propose the null global and local magnetisation symmetries to be the origin of this effect. Following our picture, $q > 4$ systems equilibrate at positive but low temperature by locally nucleating domains that eventually become of the size of system, and we characterise this nucleation with the help of an order parameter accounting for the local ordering. For the quench at zero temperature, we interpret the impossibility to equilibrate in the thermodynamic limit and for $q > 4$ as an impossibility of breaking the local zero magnetisation and of forming system-sized domains. The $q > 4$ limit is presented as a consequence of a hypothesis we propose on the symmetries of the glassy phase, which predicts also the generalization of the mentioned limit, $q > d + 2$, in d dimensions, result which coincides with the one due to Lifshitz [1].

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