Mathematical Physics

On phase transition for one dimensional countable state P-adic Potts model

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In the present paper we shall consider countable state p-adic Potts model on Z_+. A main aim is to establish the existence of the phase transition for the model. In our study, we essentially use one dimensionality of the model. To show it we reduce the problem, to the investigation of an infinite-dimensional nonlinear equation. We find a condition on weights to show that the derived equation has two solutions, which yields the existence of the phase transition. We prove that measures corresponding to first and second solutions are a p-adic Gibbs and generalized p-adic Gibbs measures, respectively. Note that it turns out that the finding condition does not depend on values of the prime p, and therefore, an analogous fact is not true when the number of spins is finite. Note that, in the usual real case, if one considers one dimensional translation-invariant model with nearest neighbor interaction, then such a model does not exhibit a phase transition. Nevertheless, we should stress that in our model there does not occur the strong phase transition, this means that there is only one p-adic Gibbs measure. Here we may see some similarity with the real case. Besides, we prove that the p-adic Gibbs measure is bounded, and the generalized one is not bounded.

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