Translation-invariant generalized P-adic Gibbs measures for the Ising model on Cayley trees

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Abstract

Main aim of the present paper is explore certain physical phenomena by means of p-adic probability theory. To overcome this study, we deal with a more general setting to define p-adic Gibbs measures. For the sake of simplicity of explanations, we restrict ourselves to the Ising model on the Cayley tree, since such a model has broad theoretical and practical applications. To study p-adic quasi Gibbs measures, we reduce the problem to the description of the fixed points of the Ising-Potts mapping. Finding fixed points is not an easy job as in the real setting. Furthermore, the phase transition for the model is established. In the real case, the phase transition yields the the singularity of the limiting Gibbs measures. However, we show that the p-adic quasi Gibbs measures do not exhibit the mentioned type of singularity, such kind of phenomena is called strong phase transition. Finally, we deal with the solvability and the number of solutions of ceratin p-adic equation depending on several parameters. Such a description allows us to find all possible translation-invariant pa-adic quasi Gibbs measures.

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