Mathematical Physics

On dynamical systems and phase transitions for $Q+1$-state P-adic Potts model on the Cayley tree

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In the present paper, we introduce a new kind of p-adic measures for $q+1$-state Potts model, called {\it p-adic quasi Gibbs measure}. For such a model, we derive a recursive relations with respect to boundary conditions. Note that we consider two mode of interactions: ferromagnetic and antiferromagnetic. In both cases, we investigate a phase transition phenomena from the associated dynamical system point of view. Namely, using the derived recursive relations we define one dimensional fractional p-adic dynamical system. In ferromagnetic case, we establish that if q is divisible by p, then such a dynamical system has two repelling and one attractive fixed points. We find basin of attraction of the fixed point. This allows us to describe all solutions of the nonlinear recursive equations. Moreover, in that case there exists the strong phase transition. If q is not divisible by p, then the fixed points are neutral, and this yields that the existence of the quasi phase transition. In antiferromagnetic case, there are two attractive fixed points, and we find basins of attraction of both fixed points, and describe solutions of the nonlinear recursive equation. In this case, we prove the existence of a quasi phase transition.

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