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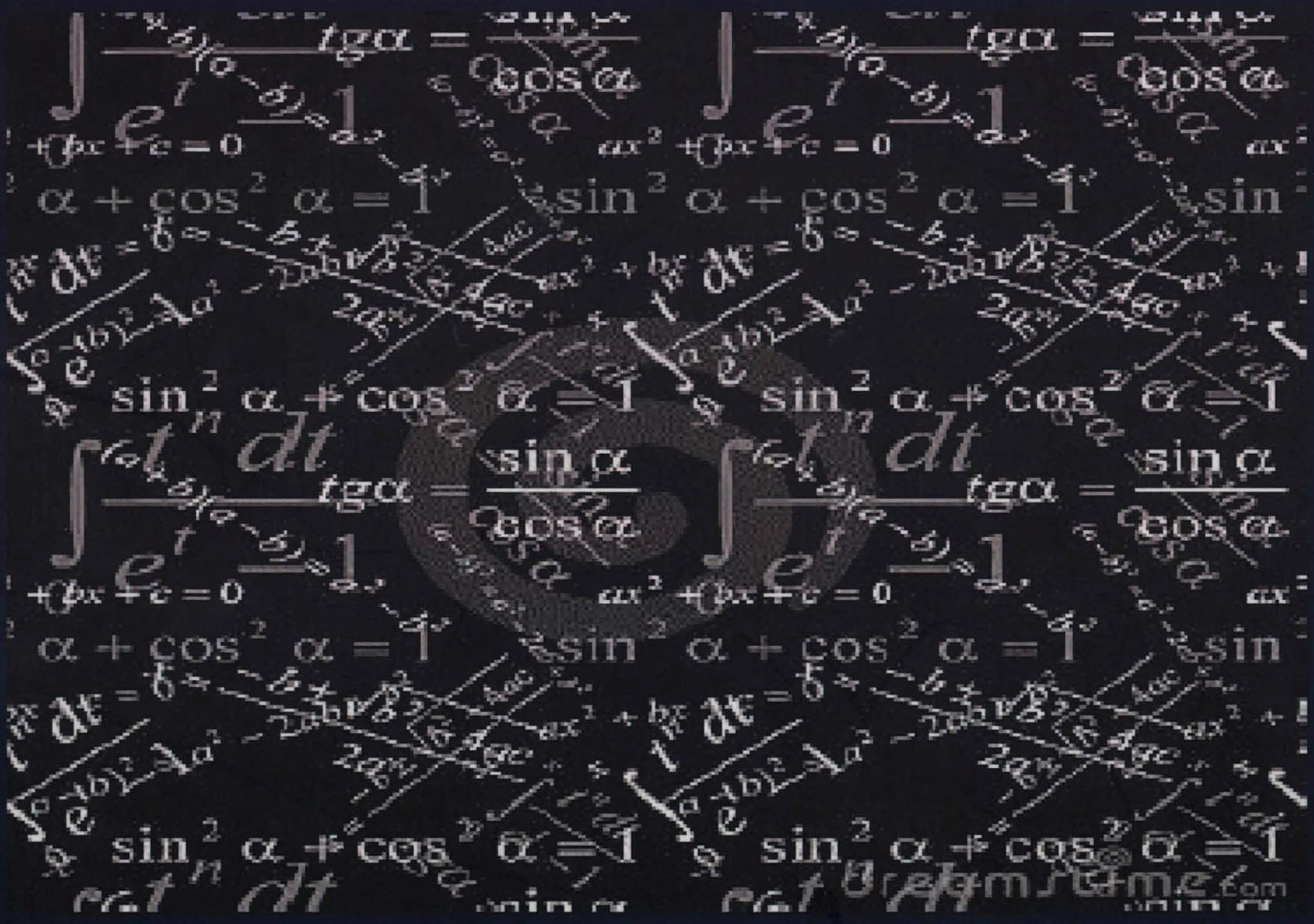

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ON POTTS MODEL WITH TRIPLE INTERACTIONS

Nasir Ganikhodjaev [1] And Seyit Temir [2]

[1] Department of Computational & Theoretical Sciences,
Faculty of Science, International Islamic University Malaysia,
P.O. Box, 141, 25710, Kuantan, Pahang, Malaysia
[2] Harran University,Department of Mathematics, Art and Science Faculty,
63200, Sanliurfa, Turkey
E-mail: [1]gnasir@iium.edu.my, [2]temirseyit@harran.edu.tr

Abstract

In the present paper we consider three-state Potts model with spin values in {1,2,3} and prove the existence of modulated phase.

Keywords: *Potts model, Cayley tree, phase diagram, modulated phase.*

Introduction

A phase diagram of a model describes a morphology of phases, stability of phases, transitions from one phase to another and corresponding transitions line. A Potts model just as an Ising model on a Cayley tree with competing interactions has recently been studied extensively because of the appearance of nontrivial magnetic orderings (see [1]-[4], [8] and references therein). The Cayley tree is not a realistic lattice; however , its amazing topology makes the exact calculation of various quantities possible. For many problems the solution on a tree is much simpler than on a regular lattice and is equivalent to the standard Bethe-Peierls theory [5]. On the Cayley tree one can consider two type of triple neighbours: prolonged and two-level (definitions see below). In the case of the Ising model with competing nearest-neighbor interactions J and prolonged next-nearest-neighbour interactions Jp Vannimenus [1] was able to find new modulated phases, in addition to the expected paramagnetic and ferromagnetic ones. From this result follows that Ising model with competing interactions on a Cayley tree is real interest since it has many similarities with models on periodic lattices. In fact, it has many common features with them, in particular the existence of a modulated phase, and shows no sign of patological behaviour - at least no more than mean-field theories of similar systems [1]. Moreover detailed study of its properties was carried out with essentially exact results, using rather simple numerical methods. This suggest that more complicated models should be studied on trees, with the hope to discover new phases or unusual types of behaviour. The important point is that statistical mechanics on trees involve nonlinear recursion equations and are naturally connected to the rich world of dynamical systems, a world presently under intense investigation [1]. In the model (1) with J_p 0 was considered in