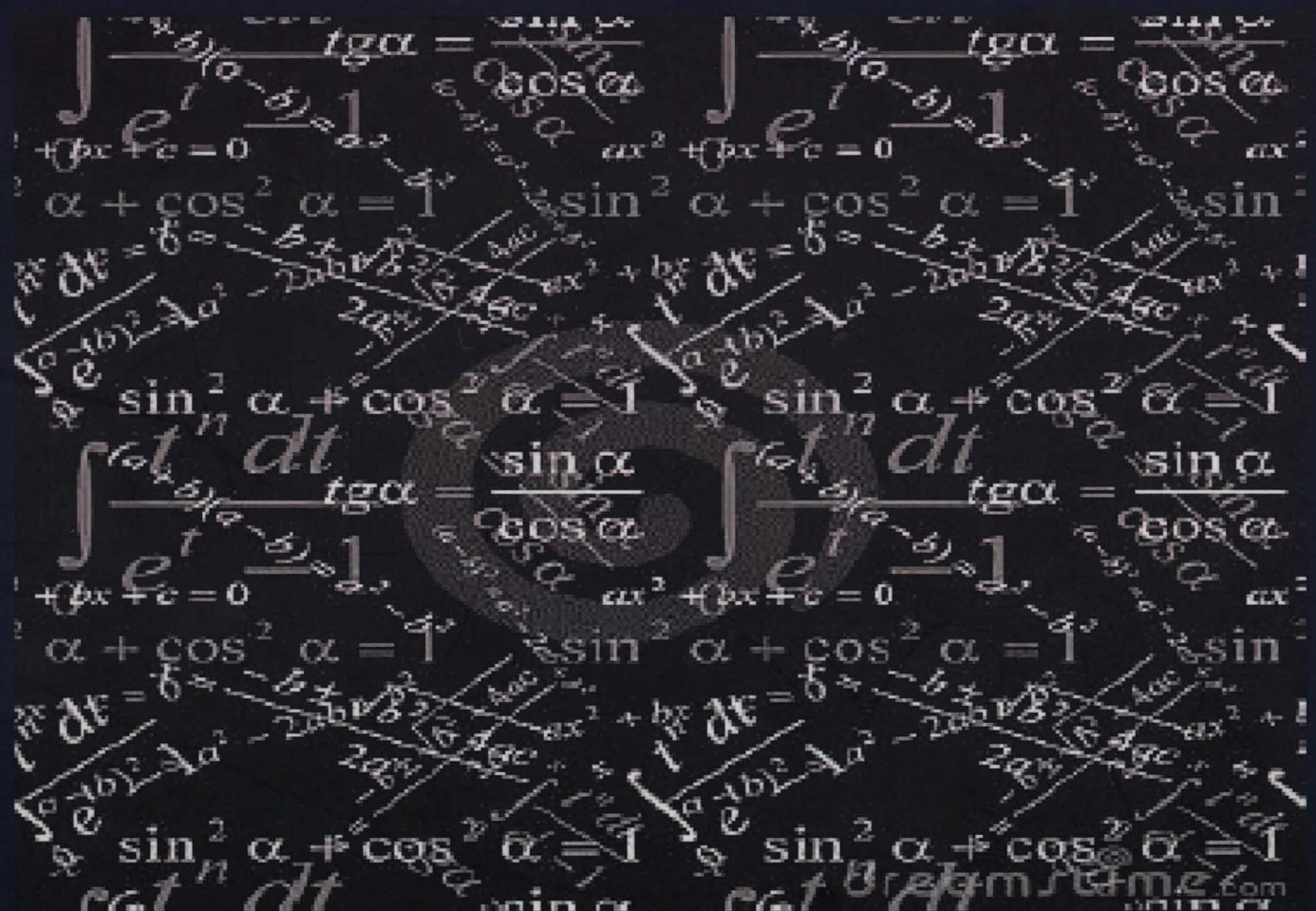




RECENT ACHIEVEMENTS IN DYNAMICAL SYSTEMS

Proceedings of Department of
Computational and Theoretical
Sciences, Faculty of Science, IIUM



Chief Editor : Farrukh Mukhamedov

Editors : Nasir Ganikhodjaev

: Mansoor Saburov

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PHASE DIAGRAM OF THE POTTS MODEL WITH EXTERNAL MAGNETIC FIELD

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Abstract.

The physical phenomenon of phase transition is reflected in mathematical model by non-uniqueness of the Gibbs measures and phase diagram of the model describes a morphology of phases, stability of phases, different transitions from one phase to another and corresponding transition lines. We study the phase diagram for the Potts model on a Cayley tree with nearest-neighbor interaction J in the presence of an external magnetic field h . To perform this study, an iterative scheme similar to that appearing in real space renormalization group frameworks is established. The phase diagram is fully determined in the $T/J - h/J$ space for all values and signs of J and h . This phase diagram explicitly demonstrates relations between parameters J , h and T , where as in previous works of Peruggi et al such relations were implicit.

Mathematical Subject Classification: 82B20, 82B26

Keywords: *Phase diagram, Phase transitions, Potts model*

Introduction

Statistical physics seeks to explain the macroscopic behavior of matter on the basis of its microscopic structure. This includes the analysis of simplified mathematical models [1],[6]. The Potts model [12] was introduced as a generalization of the Ising model to more than two components (spins). Ising model considered only up and down spins [1] whereas Potts model incorporates more possibilities of spins and their interactions. The Potts model describes an easily defined class of statistical mechanics models. At the same time, its rich structure is surprisingly capable of illustrating almost every conceivable nuance of the subject. The Potts model encompasses a number of problems in statistical physics (see, e.g. [14]).

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 [4],[7],[13]. The Cayley tree is not a realistic lattice; however, its amazing topology makes the exact calculation of various quantities possible.