

Interface Profile of the Ising Ferromagnet in Two Dimensions

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Abstract. The interface profile of the two-dimensional Ising ferromagnet is obtained for all temperatures in the thermodynamic limit. The width of the interface depends on its length as $(\text{length})^{1/2}$.

1. Introduction

Recently considerable effort has been devoted to the unravelling of the phenomenon of phase separation in the Ising ferromagnet or in the equivalent lattice gas [1, 2, 3]. This paper reports on exact calculation of the surface tension and interface profile for the two dimensional case with nearest neighbour interactions and zero “gravitational” field [0]. First we shall review briefly exact results already established and then we shall relate our computation to them.

2. Notation and Results

Let A be a crystal lattice in d dimensions with unit edges; it may therefore be regarded as a subset of \mathbb{Z}^d . At each vertex i let there be a spin $\sigma_i = \pm 1$. The energy of a spin configuration $\{\sigma\}$ is given by:

$$E_A\{\sigma\} = -J \sum_{\langle i, j \rangle \subset A} \sigma_i \sigma_j - \mathcal{B}_A\{\sigma\} \quad (2.1)$$

with associated probability measure

$$p_{A, \mathcal{B}_A}(\{\sigma\}) = Z^{-1} \exp -\beta E_A(\{\sigma\}). \quad (2.2)$$

The sum in (2.1) is over nearest neighbour pairs on A and $\mathcal{B}_A(\{\sigma\})$ is a boundary term [1], examples of which will be encountered later.

Let σ_A be defined for $A \subset \mathbb{Z}^d$ by

$$\sigma_A = \prod_{i \in A} \sigma_i \quad (2.3)$$

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