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Green Functions of the Anisotropic Heisenberg Model*

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Abstract. The Green functions of the anisotropic Heisenberg model are studied by a method which was applied previously to the reduced density matrices. Integral equations are used to prove the existence of the infinite volume limit of the Green functions, and some analyticity properties with respect to the fugacity (or magnetic field), the potentials, and the complex times.

Introduction

In a previous paper (1, hereafter referred to as I), we studied the reduced density matrices (RDM) of a quantum lattice gas which is equivalent to the anisotropic Heisenberg ferromagnet. We used a functional integral representation based on a generalized Poisson process and proved the existence of the infinite volume limit and the analyticity of the RDM with respect to the fugacity and the potentials in the low fugacity (and by symmetry, high fugacity) region. In this paper, we extend these results to the Green functions (GF) of the system. We prove for the GF the existence of the infinite volume limit and analyticity with respect to the same parameters, as well as analyticity with respect to the complex times, in some domain. With respect to the fugacity and potentials, the analyticity domain is the same as that of the RDM when all real parts of the times are equal, and decreases when their differences increase.

In Section 1, for the sake of comparison, we present general arguments that prove the analyticity of the GF with respect to the times for general systems, including the present model with physical values of the parameters. In Section 2, we describe the functional representation of the GF first for purely imaginary, and then complex times. In Section 3, we extend to the GF integral equations that were used in I for the RDM, and deduce from them our main results. We conclude in Section 4 with a brief description of the corresponding results for related models that were considered in I.

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