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Long-Distance Asymptotics of Temperature Correlators of the Impenetrable Bose Gas

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Abstract. The inverse scattering method is applied to the integrable nonlinear system describing temperature correlators of the impenetrable bosons in one space dimension. The corresponding matrix Riemann problems are constructed for two-point as well as for multi-point correlators. Long-distance asymptotics of two-point correlators is calculated.

1. Introduction

Impenetrable Bose gas in one space dimension representing bosons with the point-like infinite repulsion is the simplest nontrivial integrable model. In the state of the thermal equilibrium at temperature $T > 0$ the distribution of particles with momenta k is given by the Fermi weight $(1 + \exp\{\varepsilon(k)/T\})^{-1}$ (energy $\varepsilon(k) = k^2 - h$, h is a chemical potential). Our aim is to obtain the long-distance asymptotics of equal-time temperature correlators in the model. To do this we use essentially results of a previous paper [1], where the completely integrable system describing temperature correlators was constructed and partial differential equations for them were obtained. So the description of temperature correlators in the quantum model is reduced to the investigation of the classical nonlinear integrable system. This is done by means of the inverse scattering method in the matrix Riemann problem formulation (see, e.g. [2]).

Let us begin with introducing notations and formulating results of paper [1] further. The two-point correlators will be mainly considered, namely, the two-point field correlator

$$\langle \psi^+(z)\psi(-z)\rangle_T = (\sqrt{T}/4)B_{++}(x,t,\gamma)\Delta(x,t,\gamma)|_{\gamma=2/\pi} \tag{1.1}$$

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