Commun. Math. Phys. 79, 303–316 (1981)

Communications in
Mathematical
Physics

The Inverse Scattering Method Approach to the Quantum Shabat–Mikhailov Model

A. G. Izergin and V. E. Korepin
Leningrad Department of V. A. Steklov Mathematical Institute,
Fontanka 27, Leningrad 191011, USSR

Abstract. The Shabat–Mikhailov model is treated in the framework of the quantum inverse scattering method. The Baxter's R-matrix for the model is calculated.

1. Introduction

In this paper we consider the Shabat–Mikhailov model. This model was introduced in [1]. This model was investigated in detail for the first time in [2]. The solution of the equation of motion by means of the inverse scattering method was given in [3]. The S-matrix approach to the quantum version of the model was applied in [4], where the scattering matrix for the physical particles was calculated.

Here we consider the quantum version of the model, our approach being based on the quantum inverse scattering method [5]. This method is a generalization to the quantum case of the classical inverse scattering method proposed in [6].

The quantum inverse scattering method was successfully applied to the sine-Gordon model [7] which is somewhat similar to the model under consideration. The Hamiltonian structure of the model is of special interest for us. The angle-action variables in the framework of the classical inverse scattering method can be given in terms of scattering data [8]. One can easily express the scattering data by the monodromy matrix elements, the Poisson brackets of these elements being readily calculated by means of the classical r-matrix [9]. In Section 2 we list the main properties of the classical model and calculate the r-matrix.

In the quantum inverse scattering method, the Baxter's "quantum" R-matrix determining the commutation relations of the quantum monodromy matrix elements is important. The knowledge of these relations allows in principle the construction of all eigenfunctions of the Hamiltonian operator [5]. We propose a method of calculation of the R-matrix for the integrable field theory models based on the Yang–Baxter relations [10–14], the explicit form of the classical r-matrix, and the symmetry group of the models. For the classical version of the model considered, the corresponding symmetry group was introduced in [3].

0010-3616/81/0079/0303/$02.80