Exact *S*-Matrix of the Adjoint SU(*N*) Representation

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Abstract. We have calculated the exact factorised *S*-matrices of the adjoint SU(*N*) representation in $1+1$ space-time dimensions. Besides the trivial solution the only realised solution exhibits an $O(N^2-1)$ symmetry.

1. Introduction

Recently a lot of work has been done [1–7] in calculating exact factorising *S*-matrices in two dimensions and investigating their relationship to quantum field theoretical models. In the present paper we calculate the factorising *S*-matrix for particles which transform under the adjoint representation of SU(*N*).

Our interest in the *S*-matrix of the adjoint SU(*N*) representation was stimulated by recent investigations [8–10] on CP^{N-1} models which were introduced by Eichenherr [8]. These models are in their construction similar to the nonlinear σ-model in two dimensions. In the nonlinear σ-model the interaction is introduced by restricting the (classical) field to an orbit of $O(N)$; in analogy the interaction of the CP^{N-1} models is introduced by the geometrical constraint of restricting the classical field to an idempotency orbit of the adjoint representation of SU(*N*) [8]. Much of the interest in the nonlinear σ-model in two dimensions is motivated by the analogies found with respect to the Yang-Mills theory in four dimensions. For the CP^{N-1} models this analogy goes even further. In particular the CP^{N-1} models possess instanton solutions for all N and the instanton effects can be investigated within the $1/N$ expansion [10]. The theory can be rewritten as an abelian gauge theory [9, 10] and the fundamental fields are then confined by a topological Coulomb force.

In complete analogy to the $O(N)$ σ-model the CP^{N-1} models exhibit higher order local and non-local conservation laws. If the conservation laws survive quantization and if the spectrum of outcoming particles has at the lowest level only the adjoint SU(*N*) representation, then by arguments analogous to those first worked out for the massive Thirring model [11] the *S*-matrix calculated in the present paper describes the scattering of the mesons of the CP^{N-1} models. Of course more precise information concerning the spectrum – e.g. within the