Commun. Math. Phys. 84, 171–186 (1982)

Communications in Mathematical Physics

A Two Dimensional Lagrangian Model with Extended Supersymmetry and Infinitely Many Constants of Motion

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Abstract. The reduction of the supersymmetric graded $\frac{SU(2|1)}{S(U_2 \times U_1)}$ σ-model is discussed. If no extra constraint is imposed, one gets a set of two coupled equations (involving two scalar superfields) which generalizes the supersymmetric sine-Gordon equation. It is shown that these equations, which can be derived by a supersymmetric Lagrangian, reproduce in the bosonic limit the reduced version of the $O(4)$ σ-model (Pohlmeyer, Lund Regge, Getmanov model). Moreover the associate linear set and an infinite set of local conservation laws for this new supersymmetric model are exhibited. It turns out that, beyond the spinorial charge which generates the supersymmetry transformations, another unexpected spinorial charge is conserved; then the model appears to be invariant under $N = 2$ extended supersymmetry.

1. Introduction

A supersymmetric generalization of the sine-Gordon equation was proposed some years ago by Di Vecchia, Ferrara and Witten [1]. Later an infinite set of local conservation laws were found for this model [2]; it was shown that they survive also at the quantum level [3] and the S-matrix was calculated [4]. The proof of the classical conservation laws was given [5, 6] by introducing a "Lax set" of linear equations associated to the super sine-Gordon equation.

An interesting (purely bosonic) generalization of the sine-Gordon equation was independently proposed by Pohlmeyer, Lund and Regge [7] who showed its relationship with the $O(4)$ σ-model, and by Getmanov [8]; this model was named the Complex sine-Gordon by Getmanov, but we will call it the GLRP model in order to avoid confusion with a different complexification of the sine-Gordon equation (Complex sine-Gordon II) which was found later [9, 10]. It is very easy to write a supersymmetric generalization of the GLRP model; however for the most obvious supersymmetrization no associate linear set has been found (actually the

0010-3616/82/0084/0171/$03.20