Commun. Math. Phys. 183, 205–252 (1997)

Communications in Mathematical Physics

$N=2$ Affine Superalgebras and Hamiltonian Reduction in $N=2$ Superspace

C. Ahn[1], E. Ivanov[2,], A. Sorin[2,***]**

[1] Dept. of Physics, Kyung Hee Univ., Seoul 130-701, Korea. cahn@photon.kyunghee.ac.kr
[2] Bogoliubov Laboratory of Theoretical Physics, JINR, 141980, Dubna, Moscow Region, Russia

Received: 15 September 1995 / Accepted: 20 July 1996

Abstract: We construct $N=2$ affine current algebras for the superalgebras $sl(n|n-1)^{(1)}$ in terms of $N=2$ supercurrents subjected to nonlinear constraints and discuss the general procedure of the hamiltonian reduction in $N=2$ superspace at the classical level. We consider in detail the simplest case of $N=2$ $sl(2|1)^{(1)}$ and show how $N=2$ superconformal algebra in $N=2$ superspace follows via the hamiltonian reduction. Applying the hamiltonian reduction to the case of $N=2$ $sl(3|2)^{(1)}$, we find two new extended $N=2$ superconformal algebras in a manifestly supersymmetric $N=2$ superfield form. Decoupling of four component currents of dimension 1/2 in them yields, respectively, $u(2|1)$ and $u(3)$ Knizhnik–Bershadsky superconformal algebras. We also discuss how the $N=2$ superfield formulations of $N=2$ W_3 and $N=2$ $W_3^{(2)}$ superconformal algebras come out in this framework, as well as some unusual extended $N=2$ superconformal algebras containing constrained $N=2$ stress tensor and/or spin 0 supercurrents.

1. Introduction

For the last several years important progress has been achieved in understanding the role of world-sheet superconformal symmetry and target space symmetry of nonlinear σ-models in the context of string theory and topological field theory [1–3]. The BRST structure of the bosonic string (W_n string) generates a topologically twisted $N=2$ superconformal algebra [4] ($N=2$ super-W_n algebra [5, 6]). In obtaining these results, heavy use of the hamiltonian reduction from WZNW models based on the superalgebra $sl(n|n-1)$ has been made. Futhermore, any superstring theory possesses $N=3$ twisted supersymmetry [5]. Recently, BRST structure has been systematically constructed for superstrings with N supersymmetries by the hamiltonian reduction of the affine extension of $osp(N+2|2)$ [7]. The $N=2$ analog for topological strings is the twisted $N=4$ $su(2)$ superconformal algebra (SCA) which has been obtained by the reduction of the affine extension of $sl(2|2)$ in [8].

** E-mail: eivanov@thsun1.jinr.dubna.su
*** E-mail: sorin@thsun1.jinr.dubna.su