Commun. Math. Phys. 139, 527–549 (1991)

Communications in Mathematical Physics

Krichever-Novikov Global Operator Formalism: NSR Superstring in Curved Background

Jnanadeva Maharana [1], **Samir K. Paul** [2], **and Gautam Sengupta** [1]

[1] Institute of Physics, Bhubaneswar-751005, India
[2] S. N. Bose National Centre for Basic Sciences, DB17, Sector 1, Salt Lake, Calcutta-700064, India

Received April 15, 1990; in revised form February 21, 1991

Abstract. The Neveu-Schwarz-Ramond type II closed superstring is considered to evolve in a curved space-time manifold. The Krichever-Novikov global operator formalism is used to construct the generators of a super-conformal algebra on a Riemann surface Σ. The computation for the quantum algebra of these generators is explicitly presented. It is shown that the theory is free from super-conformal anomalies if the target manifold is ten dimensional and satisfies the Ricci flatness condition.

I. Introduction

The string theories offer the most promising prospect of unifying all fundamental forces of nature [1]. The first quantized approach has proved to be powerful to study dynamics of string interactions. Inclusion of surfaces of non-trivial topology leads to the topological expansion which has one diagram at each order [2]. Furthermore, duality and unitarity are guaranteed at each order in this perturbation theory (a Riemann surface of a given genus is associated with each order of the perturbation expansion).

The S-matrix generating functional for the scattering of massless states of the string is constructed by considering the evolution of the string in the background of the corresponding massless excitations [3]. It is well known that the consistency requirements such as super-conformal invariance impose stringent constraints on the configurations of the background fields, leading to the so-called equation of motion of such fields. Indeed, the vanishing of the β-functions associated with the background fields ensures super-conformal invariance of the theory [4].

Recently, the application of some powerful mathematical results in algebraic geometry and complex analysis on Riemann surfaces have led to a detailed understanding of the multi-loop structure of string theories, in particular in the framework of operator formulation [5, 6]. The salient feature of this formalism [5], in contrast to the path integral approach, has been a local description of