

# Free Boson Representation of $q$ -Vertex Operators and their Correlation Functions

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Received September 7, 1992

**Abstract.** A bosonization scheme of the  $q$ -vertex operators of  $U_q(\widehat{\mathfrak{sl}}_2)$  for arbitrary level is obtained. They act as intertwiners among the highest weight modules constructed in a bosonic Fock space. An integral formula is proposed for  $N$ -point functions and explicit calculation for two-point function is presented.

## 1. Introduction

One of the central subjects of mathematical physics has been studies on exactly solvable models in two dimensions for many years. Infinite dimensional symmetries such as conformal and current algebra give powerful tools to investigate systems just on the critical point [1]. It is now a very important problem how to extend the method developed in the critical theories to massive field theories and lattice models.

A breakthrough was brought by Frenkel and Reshetikhin [2] who studied the  $q$ -deformation of the vertex operator as an intertwiner between certain modules of the quantum affine algebra  $U_q(\widehat{\mathfrak{sl}}_2)$ . They showed that the correlation functions satisfy a  $q$ -difference equation, the  $q$ -deformed Knizhnik–Zamolodchikov equation, and that the resulting connection matrices give rise to the elliptic solution to the Yang–Baxter equation of RSOS models [3, 4]. Using the  $q$ -vertex operators people in the Kyoto school [5] succeeded in diagonalization of the XXZ spin chain and showed that the spectra of the XXZ model is completely determined in terms of the representation theory of  $U_q(\widehat{\mathfrak{sl}}_2)$ . Furthermore, they found an integral formula for correlation functions of the local operators of the XXZ model [6] by utilizing bosonization of  $U_q(\widehat{\mathfrak{sl}}_2)$  of level one [7] and the bosonized  $q$ -vertex operators.

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\* Partly supported by the Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture (No. 04245206)

\*\* A Fellow of the Japan Society of the Promotion of Science for Japanese Junior Scientists. Partly supported by the Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture (No. 04-2297)