Accepted Manuscript

Gauged Floreanini-Jackiw type chiral boson and its BRST quantization
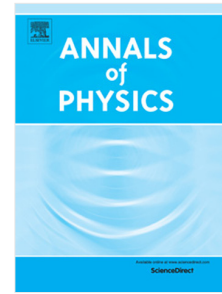
Anisur Rahaman, Safia Yasmin

Please cite this article as: A. Rahaman, S. Yasmin, Gauged Floreanini-Jackiw type chiral boson and its BRST quantization, *Annals of Physics* (2017), http://dx.doi.org/10.1016/j.aop.2017.06.005

Gauged Floreanini-Jackiw type chiral boson and its BRST quantization

Anisur Rahaman[*]

Hooghly Moghin College, Chinsurah, Hooghly-712101, West Bengal, India

Safia Yasmin

Indas Mahavidyalaya, Bankura - 722205, West Bengal, India

(Dated: June 1, 2017)

The gauged model of Siegel type chiral boson is considered. It has been shown that the action of gauged model of Floreanini-Jackiw (FJ) type chiral boson is contained in it in an interesting manner. A BRST invariant action corresponding to the action of gauged FJ type chiral boson has been formulated using Batalin, Fradkin and Vilkovisky based improved Fujiwara, Igarishi and Kubo (FIK) formalism. An alternative quantization of the gauge symmetric action has been made with a Lorentz gauge and an attempt has been made to establish the equivalence between the gauge symmetric version of the extended phase space and original gauge non-invariant version of the usual phase space.

PACS numbers:

I. INTRODUCTION

The self-dual field in (1+1) which is also known as chiral boson is the basic ingredient of heterotic string theory [1–4]. This very chiral boson plays a crucial role in the study of quantum hall effect too [5, 6]. Seigel initiated the study of chiral boson in his seminal work [7]. Another description of chiral boson came from the work of Srivastva [8]. In these two descriptions [7, 8], the lagrangian of chiral boson were constituted with the second order time derivative of the field. In the description of Seigel chiral constraint was in a quadratic form where as in the description of Srivastava it was in a linear form. One more ingenious description of chiral boson came from the description of Floreanini and Jackiw [9]. In this description the lagrangian of chiral boson was constituted with first order time derivative of the field. In Ref [10], we find an interesting description towards quantization of that free FJ type chiral boson. In a very resent work [8], we find an application of augmented super field approach to derive the off-shell nilpotent and absolutely anti-commuting (anti-)BRST and (anti-)co-BRST symmetry transformations for the BRST invariant Lagrangian density of a free chiral boson. Another recent important development towards the BFV quantization of the free chiral boson along with study of Hodge decomposition theorem in the context of conserved charges has came in [11]

The obvious generalization of free chiral boson is to take into account of the interaction of gauge field with that and this interacting field theoretical model is known as gauged model of chiral boson. The interacting theory of chiral boson was first described by Bellucci, Golterman and Petcher [13] with Seigel like kinetic term for chiral boson. So naturally the theory of interacting chiral boson with FJ type kinetic was wanted for as free FJ type chiral boson became available in [9] and that was successfully met up by Harada [14]. After the work of Harada [14], interacting chiral boson based on FJ type kinetic term attracted considerable attention [15–20] in spite of the fact that this theory of interacting chiral boson was not derived from the iterating theory of chiral boson as developed in [13]. Harada obtained it from Jackiw-Rajaraman (JR) version of chiral Schwinger model with an ingenious insertion of a chiral constraint in the phase space this theory [21]. So there is a missing link between the two types of interacting gauged chiral boson. An attempt towards search for a link is, therefore, a natural extension which we would like to explore. In fact, we want to show whether the gauged model of FJ type chiral boson is contained within the gauged chiral boson of Seigel type chiral boson which is available in [13]. The study of this model may be beneficial from another another point of view indeed; where anomaly is the central issue of investigation [14, 17, 21–25, 27], since it is known from Ref. [14] that the model took birth from the JR version of chiral Schwinger model and it is known that chiral generation of Schwinger model [28] due to Hagen [26] gets secured from unitarity problem when anomaly was taken into consideration in it by Jackiw and Rajaraman [21]. In this respect, the recent chiral generation of Thirring-Wess model is of worth-mentioning [29, 30]. So when the issue of searching of the desired link gets settled

---

[*]Electronic address: `1.anisur.rahman@saha.ac.in,2.manisurn@gmail.com`