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ACCEPTED MANUSCRIPT

ON THE UNITARY STRUCTURES OF VERTEX OPERATOR SUPERALGEBRAS

CHUNRUI AI AND XINGJUN LIN

Abstract. In this paper, the notion of unitary vertex operator superalgebra is introduced. It is proved that vertex operator superalgebras associated to unitary highest weight representations for the Neveu-Schwarz Lie superalgebra, Heisenberg superalgebras and to positive definite integral lattices are unitary vertex operator superalgebras. The unitary structures are then used to study the structures of vertex operator superalgebras, it is proved that any unitary vertex operator superalgebra is a direct sum of strong CFT type unitary simple vertex operator superalgebras. The classification of unitary vertex operator superalgebras generated by subspaces with conformal weights less than or equal to 1 is also considered.

1. Introduction

Unitary structures of vertex operator algebras were introduced in the early days of vertex operator algebras, the unitary structures of the lattice vertex operator algebras and Moonshine vertex operator algebra were used to study the Monster group [B], [FLM]. Later, based on a symmetric contravariant bilinear form with respect to a Cartan involution in [B] for a vertex algebra constructed from an even lattice, the notion of invariant bilinear form was introduced and studied in [FHL], [L1].

Recently, it was found in [DLin] that the positive definite Hermitian forms of vertex operator algebras which are invariant with respect to anti-linear involutions of vertex operator algebras can be used to define unitary vertex operator algebras. And it was proved in [DLin] that the vertex operator algebras associated to the unitary highest weight representations for the Heisenberg algebras, Virasoro algebra and affine Kac-Moody algebras are unitary vertex operator algebras. Moreover, the unitary structures of these vertex operator algebras are induced from the unitary structures of the highest weight modules for the corresponding Lie algebras. The unitary structures of vertex operator algebras were later used to construct conformal nets from vertex operator algebras [CKLW].

In the first part of this paper, the notion of unitary vertex operator superalgebra is introduced, this is a generalization of the notion of unitary vertex operator algebra. It is then proved that the vertex operator superalgebras associated to the unitary highest

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