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Introduction to Vertex Operator Superalgebras and Their Modules

Vertex algebra was introduced by Boreherds, and the slightly revised notion "vertex oper ator algebra" was formulated by Frenkel, Lepowsky and Meurman, in order to solve the problem of the moonshine representation of the Monster group - the largest sporadie group. On the one hand, vertex operator algebras ean be viewed as extensions of eertain infinite-dimensional Lie algebras such as affine Lie algebras and the Virasoro algebra. On the other hand, they are natural one-variable generalizations of commutative associative algebras with an identity element. In a certain sense, Lie algebras and commutative asso ciative algebras are reconciled in vertex operator algebras. Moreover, some other algebraie structures, such as integral linear lattiees, Jordan algebras and noncommutative associa tive algebras, also appear as subalgebraic structures of vertex operator algebras. The axioms of vertex operator algebra have geometrie interpretations in terms of Riemman spheres with punctures. The trace functions of a certain component of vertex operators enjoy the modular invariant properties. Vertex operator algebras appeared in physies as the fundamental algebraic structures of eonformal field theory, whieh plays an important role in string theory and statistieal meehanies. Moreover,eonformalfieldtheoryreveals animportantmathematiealproperty,the so called "mirror symmetry" among Calabi-Yau manifolds. The general correspondence between vertex operator algebras and Calabi-Yau manifolds still remains mysterious. Ever since the first book on vertex operator algebras by Frenkel, Lepowsky and Meur man was published in 1988, there has been a rapid development in vertex operator su peralgebras, which are slight generalizations of vertex operator algebras.

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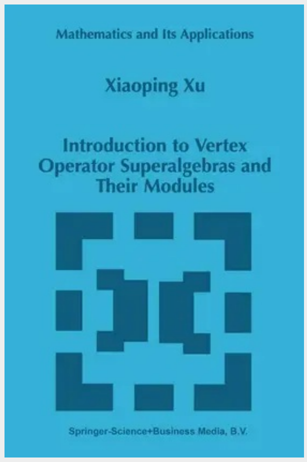

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