

## SHc Description of Minimal Models and Triality

その他のタイトル	SHc代数によるミニマル模型とトライアリティの記述
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## 論文の内容の要旨

論文題目  $\text{SH}^c$  Description of Minimal Models and Triality  
( $\text{SH}^c$  代数によるミニマル模型とトライアリティの記述)

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In the efforts to prove the 4-dimensional supersymmetric gauge theory/2-dimensional conformal field theory correspondence, a new series of bases for representation spaces of  $\mathcal{W}$ -algebras was found. In the case of the  $\mathcal{W}_N$ -algebra, such a basis has an interpretation as the set of all fixed points in the moduli space of  $U(N)$ -instantons on a 4-dimensional spacetime. Using the new basis, one can construct an action of a nonlinear algebra  $\text{SH}^c$  explicitly which is found to be equivalent to a representation of the  $\mathcal{W}_N$ -algebra. The explicitness opens a way to prove the correspondence by rather simple computations and has led to proofs of several versions of the conjecture.

In this thesis, we study 2-dimensional conformal field theories using the new type algebra  $\text{SH}^c$  in anticipation that the new basis simplifies known properties and gives new structures behind them. We reconsider minimal models, the level-rank duality and the triality relation in particular and describe them in terms of the explicit action of  $\text{SH}^c$ .

We prove that, for each minimal model representation, there is a corresponding irreducible representation of  $\text{SH}^c$ . We obtain a basis of its representation space thanks to its explicit construction and find that it satisfies the  $N$ -Burge condition. The  $\text{SH}^c$  descriptions of minimal model representations then reveal that there is a partially ordered set structure behind the level-rank duality. A minimal model representation space is spanned by the above basis consisting of some  $N$ -tuple Young diagrams. Shuffling their rows by following a single rule, we can map the representation to its level-rank dual representation spanned by some  $M(\neq N)$ -tuple Young diagrams. It suggests that we should change how to label the rows and leads to the notion of a  $P$ -partition over a partially ordered set, an integer partition compatible to the partial order. The shuffling means that we see a single  $P$ -partition in two different multiple Young diagrams. The theory of  $P$ -partitions reproduces a connection between the Rogers–Ramanujan identities and the Lee–Yang singularity. There is another mapping between representations of  $\text{SH}^c$ . The map is obtained from the fact that the

transposition of a Young diagram is also a Young diagram. Combining it with the level-rank duality, we obtain a triality relation of  $\text{SH}^c$ . This triality is analogous to the triality relation of another algebra  $\mathcal{W}_\infty[\mu]$ .