

論文の内容の要旨

論文題目 SH^c Description of Minimal Models and Triality
(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 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 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 SH^c .

We prove that, for each minimal model representation, there is a corresponding irreducible representation of 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 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 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 SH^c . This triality is analogous to the triality relation of another algebra $\mathcal{W}_\infty[\mu]$.