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7. Lie Groups and Lie Algebras

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Quasifinite Highest Weight Modules over the Lie algebra of Matrix Differential Operators on the circle

We describe the quasifinite highest weight modules over the central extension of the Lie algebra of $M \times M$-matrix differential operators on the circle and obtain them in terms of representations of the Lie algebra $\widehat{gl}(\infty, R_m)$, where $R_m = \mathbb{C}[t]/(t^{m+1})$. We classify the unitary ones, and construct them in terms of charged free fermions. This construction provides a large (and conjecturally complete) family of irreducible modules over the associated vertex algebra $W^M_{1+\infty,c}$, where $c \in \mathbb{N}$.

Reference: C. Boyallian, V. Kac, J. Liberati, C. Yan, "Quasifinite Highest Weight Modules over the Lie algebra of Matrix Differential Operators on the circle", to appear in Jour. Math. Phys.