
Hopf25

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The orbit method for the Virasoro algebra

Let $W = \mathbb{C}[t, t^{-1}]\partial_t$ be the Witt algebra of algebraic vector fields on \mathbb{C}^* and let Vir be the Virasoro algebra, the unique nontrivial central extension of W . Sierra showed that Poisson primitive ideals of $S(W)$ and $S(\text{Vir})$ can be constructed by elements of W^* and Vir^* of a particular form, called local functions. In this paper, we show how to use a local function on W or Vir to construct a representation of W or Vir . We further show that the annihilators of these representations are new completely prime primitive ideals of $U(W)$ and $U(\text{Vir})$. We define a version of the Dixmier map from the Poisson primitive spectrum of $S(\text{Vir})$ and $S(W)$ to the primitive spectrum of the $U(\text{Vir})$ and $U(W)$, respectively, successfully extending the orbit method from finite-dimensional solvable Lie algebras to the countable-dimensional setting. We construct various ring homomorphisms from $U(W)$ to the tensor product of a localized Weyl algebra and the enveloping algebra of a finite-dimensional solvable subquotient of W . We further show that the kernels of these maps are intersections of the primitive ideals constructed from natural subsets of W^* . As a corollary, we disprove the conjecture that any primitive ideal of $U(W)$ is the kernel of some map from $U(W)$ to the first Weyl algebra.