On the nullcone of representations of reductive groups

Abstract:

Let G be a complex reductive group and V a G-module. Let $\pi\colon V \to V/\!/G$ be the quotient morphism and set $N(V) := \pi^{-1}(\pi(0))$. Problem: *When is the null cone $N(V)$ reduced, i.e., when is the ideal of $N(V)$ generated by G-invariant polynomials?*

Jointly with G.W. Schwarz we have developped several methods to study this question, the method of covariants, a special slice method and a method based on the study of the weight system and the components of the nullcone. We have complete results when G is SL_2, SL_3 or a simple group of adjoint type, and also when G is semisimple of adjoint type and the G-module V is irreducible.