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Graded-simple algebras and modules via the loop construction

The construction of (twisted) loop and multiloop algebras plays an important role in the theory of infinite-dimensional Lie algebras. Given a grading by $\mathbb{Z}/m\mathbb{Z}$ on a semisimple Lie algebra, the loop construction produces a $\mathbb{Z}$-graded infinite-dimensional Lie algebra.

This was generalized by Allison, Berman, Faulkner and Pianzola to arbitrary nonassociative algebras and arbitrary quotients of abelian groups. In view of their results, the recent classification of gradings by arbitrary abelian groups on finite-dimensional simple Lie algebras (over an algebraically closed field of charactersitic zero) yields a classification of finite-dimensional graded-simple Lie algebras.

Mazorchuk and Zhao have recently applied the loop construction to modules. In this talk, we will show how this leads to a classification of finite-dimensional graded-simple modules over simple Lie algebras with a grading. This is joint work with Alberto Elduque.