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Exceptional modules for wild canonical algebras

ABSTRACT: This talk is about joint work with Hagen Meltzer. It concerns classic problems of representation theory of finite dimensional algebras and non-commutative algebraic geometry. Using Gabriels theorem nowadays modules over such algebras are described by vector spaces and linear maps (matrices). An important result proved by Ringel says that each exceptional module over the path algebra of a finite quiver without oriented cycles can be determined by matrices having as coefficients only 0 and 1. Further, Dräxler showed a similar result for algebras of finite representation type.

Let $\Lambda = \Lambda(\underline{p}, \underline{\lambda})$ be a canonical algebras given by a sequence of weights $\underline{p} = (p_1, \ldots, p_t)$ and a sequence of parameters $\underline{\lambda} = (\lambda_3 = 1, \lambda_4, \ldots \lambda_t)$. These algebras have been introduced by Ringel. Concerning the complexity of the structure of the module category of Λ we distinguish three types: domestic, tubular and wild. In the domestic case Kussin and Meltzer showed that each indecomposable module can be obtained by matrices with coefficients -1, 0, 1. In the tubular case Meltzer proved that for $t = 3$ each exceptional Λ-module can be exhibited again by matrices involving as coefficients 0, 1 and -1. There is one more type of tubular canonical algebras, namely of weight type $(2, 2, 2, 2)$ and depending on one parameter λ, this one is also needed in the description of the exceptional modules.

In the case of wild canonical algebras we proved that almost each exceptional module can be described by matrices with coefficients $\lambda_i - \lambda_j$. In our approach, we use a geometrical description to modules over canonical algebras, the (graded) theory of coherent sheaves over weighted projective lines $\mathbb{X}$ in the sense of Geigle and Lenzing. An important step in the proof of the result above the application of Schofield induction to exceptional vector bundles on $\mathbb{X}$.