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Koszul algebras and sheaves over projective space (25-30)

We use the methods of Koszul algebras to study the category of coherent sheaves over projective space. Let $\Lambda = K \langle x_0, x_1, \dots, x_n \rangle / \langle x_i^2, x_i x_j + x_j x_i \rangle$ be the exterior algebra and $\Gamma = K[x_0, x_1, \dots, x_n]$ the polynomial algebra, the algebra Λ is a finite dimensional Koszul algebra with Yoneda algebra Γ , by Serre theorem the quotient category $Qgr\Gamma$ of the finitely generated graded Γ -modules, modulo the modules of finite length, is equivalent to the category of coherent sheaves on projective space, we have the canonical functor: $\pi : gr\Gamma \rightarrow Qgr\Gamma$ from the category of finitely generated graded modules to the quotient category, and Koszul duality $F : K_\Lambda \text{ rightarrow } K_\Gamma$, from the category of Koszul Λ -modules to the corresponding Γ -modules, we characterize the Koszul Λ -modules M such that $\pi F(M)$ is locally free. We prove that the categories of coherent sheaves $Qgr\Gamma$ and the category of locally free sheaves have both relative right almost split sequences, as a corollary we obtain that there exists indecomposable vector bundles over projective space of arbitrarily high rank.