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Derived category of squarefree module

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Generalizing Stanley-Reisner rings, the author introduced the notion of *square-free modules* over a polynomial ring (more generally, a normal semigroup ring, etc.). This is a very useful tool for Combinatorial Commutative Algebra.

Let $\text{Sq } S$ be the category of squarefree modules over $S = K[x_1, \dots, x_n]$, and $\mathbf{D}^b(\text{Sq } S)$ its bounded derived category. In this talk, we see interesting properties of $\mathbf{D}^b(\text{Sq } S)$. For example, it admits two “duality functors” \mathbf{D} and \mathbf{A} . The former is a usual one with $H^i(\mathbf{D}(M)) \cong \text{Ext}_S^{n-i}(M, \omega_S)$, and \mathbf{A} is combinatorial one called *Alexander duality*. We have that $(\mathbf{A} \circ \mathbf{D})^3$ is identity up to translation. This phenomena can be interpreted as the “fractional Calabi-Yau property”. We also show that $M \in \text{Sq } S$ gives a *constructible sheaf* M^+ on the $(n-1)$ -simplex B . In this context, \mathbf{D} corresponds to *Poincare-Verdier duality* for sheaves on B .
