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Hochschild cohomology and the derived class of m-cluster tilted algebras of type $\mathbb{A}$

Joint work with V. Gubitosi, from Sherbrooke, see http://arxiv.org/abs/1201.4182

For a given integer m and a hereditary algebra H, the m-cluster category of H, $\mathcal{C}_m(H)$ is obtained from the derived category $\mathcal{D}(H)$ by identifying the Auslander-Reiten translation with the m^{th} power of the shift $[1]^m := [m]$. In $\mathcal{C}_m(H)$ there are cluster tilting objects, whose endomorphisms algebras are called m-cluster tilted algebras.

The aim of this work is to classify the algebras that are derived equivalent to m-cluster tilted algebras of type $\mathbb{A}$. The first result states that a connected algebra $A = kQ/I$ is derived equivalent to an m-cluster tilted algebra of type $\mathbb{A}$ if and only of it is gentle, having exactly $|Q_1| - |Q_0| + 1$ oriented cycles of length $m + 2$ each of which has full relations. We then prove:

Theorem: Let $A = kQ/I$ and $A' = k'Q'/I'$ be connected algebras derived equivalent to m-cluster tilted algebras of type $\mathbb{A}$. Then (among others) the following conditions are equivalent.

1. A and A' are derived equivalent,
2. A and A' are tilting-cotilting equivalent,
3. $\mathrm{HH}^*(A) \simeq \mathrm{HH}^*(A)$ and $K_0(A) \simeq K_0(A')$
4. $\pi_1(Q, I) \simeq \pi_1(Q', I')$ and $|Q_0| = |Q'_0|$.

Our approach differs from previous works on related topics in the fact that we use the Hochschild cohomology ring as a derived invariant. We shall discuss about the proof and derive some consequences, among which we recover previous known results.