

## Algebra Session - Tuesday, September 20, 2022

9:00

**Leonard Rubyo y De Grassi, University of Verona**

Hochschild cohomology groups under gluing idempotents

10:00

**Giovanna Le Gros, University of Padova**

Generalisations of Bass' Theorem P over commutative rings

11:00-12:30 discussion

### Abstracts

**Leonard Rubyo y De Grassi, University of Verona**

Hochschild cohomology groups under gluing idempotents

Abstract: Stable equivalences occur frequently in the representation theory of algebras and groups; however, these equivalences are poorly understood. For example, the long-standing Auslander-Reiten conjecture, which predicts that stably equivalent Artin algebras have the same number of isomorphism classes of non-projective simple modules, is still open.

An interesting class of stable equivalences are obtained by 'gluing' two idempotents. More precisely, let  $A$  be a finite dimensional algebra with a simple projective module and a simple injective module. Assume that  $B$  is a subalgebra of  $A$  having the same Jacobson radical. Then  $B$  is constructed by identifying the two idempotents belonging to the simple projective module and to the simple injective module, respectively.

In this talk we will compare the first Hochschild cohomology groups of finite dimensional monomial algebras under gluing two arbitrary idempotents (hence not necessarily inducing a stable equivalence). As a corollary, we will show that stable equivalences obtained by gluing two idempotents provide 'some functoriality' to the first Hochschild cohomology. More precisely, we will show that  $HH^1(A)$  is isomorphic to a quotient of  $HH^1(B)$ .

This is joint work with Yuming Liu and Can Wen

**Giovanna Le Gros, University of Padova**

Generalisations of Bass' Theorem P over commutative rings

Abstract. Perfect rings were introduced and characterised by Bass in his pivotal 1960 paper. In Theorem P of this paper, Bass gives both a homological and ring-theoretic characterisation of these rings, moreover finding a connection between approximation theory in the module category over the ring and the finitistic dimensions of a ring. In particular, for a commutative ring  $R$ ,  $R$  is perfect (that is, every  $R$ -module has a projective cover) if and only if the big finitistic dimension of  $R$  is zero.

In this talk we will discuss some natural generalisations of this theory, in particular considering the rings over which the class of modules of projective dimension at most one is covering, and some partial results in this direction in the case of commutative rings. This study is related to Enochs' Conjecture, that is that a covering class is necessarily closed under direct limits, in the specific case of the class of modules of projective dimension at most one.