
Interactions between Algebraic Geometry and Ring Theory
Interactions entre géométrie algébrique et théorie des anneaux
(Org: **Jason Bell** (SFU) and/et **Colin Ingalls** (UNB))

TOM CASSIDY, Bucknell University, Lewisburg, PA, USA
Quadratic algebras with Ext algebras generated in two degrees

A graded k -algebra is called δ -Koszul if the corresponding Yoneda algebra $\text{Ext}(k, k)$ is finitely generated and $\text{Ext}^{i,j}(k, k)$ is zero unless $j = \delta(i)$ for some function $\delta: \mathbb{N} \rightarrow \mathbb{N}$. Green and Marcos ask if there is a bound N such that for any δ -Koszul algebra A , $\text{Ext}(k, k)$ will be generated in degrees 0 to N . I will answer this by showing that for any integer $m \geq 3$ there is a non-commutative quadratic δ -Koszul algebra for which the Yoneda algebra is generated in degrees $(1, 1)$ and $(m, m + 1)$. These algebras are not Koszul but are m -Koszul (in the sense of Backelin).

LARISSA HORN, Wake Forest University
Tensor Products of Jacobson Rings

Recall that a ring is called Jacobson if every prime image is semiprimitive. We show that the tensor product of a Jacobson ring with a simple algebra is still Jacobson. This extends results of Krempe and broadens a set of examples given by Jordan.

ELLEN KIRKMAN, Wake Forest University, Winston Salem, NC, USA
Invariant Subrings of Regular Algebras under Hopf Algebra Actions

The Shephard–Todd–Chevalley Theorem states that if a finite group G acts on a commutative polynomial ring $A = k[V]$ as elements of $\text{GL}_n(V)$, then the ring of invariants A^G is a polynomial ring if and only if G is generated by reflections. In the same context Watanabe’s Theorem states that if G acts on A as elements of $\text{SL}_n(V)$, then the ring of invariants A^G is a Gorenstein ring. We consider generalizations of these theorems to the noncommutative setting where A is a noetherian Artin–Schelter regular algebra with a finite group G acting linearly on A . More generally we consider actions on A by a finite dimensional semi-simple Hopf algebra H , where each homogeneous component A_j is an H -module and A is an H -module algebra.

Joint with James Kuzmanovich and James Zhang.

ED LETZTER, Temple University, Philadelphia, PA 19122, USA
Detecting Infinitely Many Irreducible Representations in a Fixed Finite Dimension

Let n be a positive integer, let k be a field (of arbitrary characteristic), and let R be a finitely presented k -algebra. We consider the problem of algorithmically determining whether or not R has infinitely many distinct equivalence classes of irreducible n -dimensional representations. The approach combines Artin–Procesi Theory, Shirshov’s Theorem, and computational commutative algebra.

SHIPING LIU, Université de Sherbrooke, 2500 Boul. Université, Sherbrooke, Québec
The Auslander–Reiten theory in a triangulated category

A common subject of study in algebraic geometry, algebraic topology and the representation theory of finite dimensional algebras is the derived category of an abelian category, which is naturally equipped with the structure of a triangulated category. If a triangulated category admits a Serre functor, then it has Auslander–Reiten triangles. In this case, one can define the Auslander–Reiten quiver. The purpose of this talk is to describe the shapes of the connected components of the Auslander–Reiten quiver of such a triangulated category.

MARTIN LORENZ, Temple University, Philadelphia, PA 19122

Algebraic group actions on noncommutative spectra

Let G be an affine algebraic group that acts rationally by algebra automorphisms on an arbitrary associative algebra R . We study the induced G -action on the spectrum of all prime ideals of R , viewed as a topological space with the Jacobson-Zariski topology. The main themes are local closedness of G -orbits and the so-called G -stratification of the prime spectrum. Our principal results are based on, and generalize, prior work of Moeglin & Rentschler and Vonessen.

BAHRAM RANGIPOUR, University of New Brunswick

Duality in Hopf cyclic cohomology of x -Hopf algebras

Hopf x -algebras have recently received lots of attention as the most general symmetry of rings with several objects. In this talk we show that the cyclic duality, which is a beautiful property of Hopf cyclic cohomology of Hopf algebras, will extend to x -Hopf algebras.

DAVID SALTMAN, Center for Communications Research-Princeton

Ramification in Bad Characteristics

Let C be a curve over a p -adic field F and $K = F(C)$. For division algebras of exponent prime to p , it is known that index divides the square of the exponent and division algebras of prime degree are cyclic. Both results avoid the prime p because in that case there is no good theory of ramification of Brauer group elements. However, one can try and avoid this obstacle by defining the ramification group of a discrete valued field K with valuation ring R as the quotient of Brauer groups $\text{Br}(K)/\text{Br}(R)$ and then study the functorial properties of this quotient. One is then led to the complete case and to consider the paper *A generalization of local class field theory by using K groups I*, by Kazuya Kato (J. Fac. Sci. Univ. Tokyo Sect. IA **26**(1979), 303–376). We will discuss the progress we have made on this problem using Kato's work.

AGATA SMOKTUNOWICZ, University of Edinburgh

Makar–Limanov's conjecture on free subalgebras

The purpose of this talk is to show that over every countable field K there is a nil algebra R such that the algebra obtained from R by extending the field K contains noncommutative free subalgebras of arbitrarily high rank.

It is also shown that over every countable field K there is an algebra R without noncommutative free subalgebras of rank two such that the algebra obtained from R by extending the field K contains a noncommutative free subalgebra of rank two. This answers a question of Makar–Limanov.

ASHISH SRIVASTAVA, Saint Louis University, St. Louis, MO, USA

A New Characterization of Right Noetherian Rings

It is well known that a ring R is right noetherian if and only if every direct sum of injective right R -modules is injective. We show that a ring R is right noetherian if and only if for every injective right R -module M , each essential extension of $M^{(\aleph_0)}$ is a direct sum of modules that are either injective or projective.

This is a joint work with Pedro A. Guil-Asensio and S. K. Jain.

HUGH THOMAS, University of New Brunswick

Faithfulness of braid group actions on derived categories

Inspired by homological mirror symmetry, Paul Seidel and Richard Thomas constructed braid group actions on derived categories of coherent sheaves of various varieties and proved faithfulness of such actions for braid groups of type A . I will discuss joint work with Christopher Brav giving some faithfulness results for derived braid group actions of types D and E .

HOKUTO UEHARA, Tokyo Metropolitan University, Tokyo 192-0397, Japan
Fourier–Mukai numbers of minimal elliptic rational surfaces

For a given smooth projective variety X , the cardinality of the set of isomorphism classes of smooth projective varieties which are derived equivalent to X is called Fourier–Mukai number of X .

I find a formula of Fourier–Mukai numbers of minimal elliptic rational surfaces.

As its application, I give an example of a pair of minimal model 3-folds with Kodaira dimensions 1, $h^1(\mathcal{O}) = h^2(\mathcal{O}) = 0$ such that they are mutually derived equivalent, deformation equivalent, but not birationally equivalent. It also supplies a counterexample of the birational Torelli problem.

MICHAELA VANCLIFF, University of Texas at Arlington, Math. Dept., Arlington, TX 76019-0408
Graded Skew Clifford Algebras

The talk will focus on a generalization of graded Clifford algebras, called graded skew Clifford algebras. Regularity of such algebras is determined by a simple geometric condition. Some families of examples of such algebras will be presented that are regular quadratic algebras of global dimension four having a finite point scheme (typically twenty distinct points) and a one-dimensional line scheme.

The work discussed is joint with Thomas Cassidy.