UNIVERSITY OF MICHIGAN
Department of Mathematics

Seminar & Events Bulletin: Commutative Algebra

01-01-2013 to 06-30-2013

Thursday, January 10, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Greg Muller (Louisiana State University) *Locally acyclic cluster algebras* -- 3096 East Hall

Thursday, January 31, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Daniel Erman (University of Michigan) *Laurent Polynomials and Eulerian Numbers* -- 3096 East Hall

Thursday, February 07, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Luis Nunez-Betancourt (University of Michigan) *Associated primes of local cohomology of flat extensions with regular fibers* -- 3096 East Hall

Thursday, February 14, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Mathias Lederer (UniversitÃ¤t Bielefeld) *Geometric Littlewood-Richardson rules* -- 3096 East Hall

Thursday, February 21, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Morgan Brown (University of Michigan) *Finite generation in characteristic 0 and characteristic p* -- 3096 East Hall

Thursday, February 28, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Jesse Burke (UCLA) *Graded matrix factorizations and complete intersections* -- 3096 East Hall

Thursday, March 14, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Will Traves (US Naval Academy) *From Pascal's Theorem to Constructible Curves* -- 3096 East Hall

Thursday, March 21, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Jenna Rajchgot (University of Michigan) *Doubly Universal Grobner bases* -- 3096 East Hall

Thursday, March 28, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Florian Enescu (Georgia State University) *On strong test ideals* -- 3096 East Hall

Thursday, April 04, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Mel Hochster (University of Michigan) *Ideals and algebras generated by forms of degree at most 4 in polynomial rings* -- 3096 East Hall

Thursday, April 11, 2013	
3:00pm-4:00pm	**Commutative Algebra** -- Diane Maclagan (University of Warwick) *Tropical Commutative Algebra* -- 3096 East Hall

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Abstracts

Commutative Algebra
Thursday, January 10, 2013, 3:00pm-4:00pm
3096 East Hall
Greg Muller (Louisiana State University)
Locally acyclic cluster algebras

Cluster algebras are combinatorially-defined algebras with distinguished elements called cluster variables, which satisfy a remarkable array of special properties. Cluster algebras have been discovered in the function algebras of many classically-studied spaces, such as spaces of matrices, Grassmannians, and decorated Teichmuller spaces. We will study general cluster algebras geometrically, by considering certain localizations which are naturally simpler cluster algebras. When a cluster algebra can be covered (geometrically) by sufficiently simple cluster algebras, it is `locally acyclic'. This includes `most' cluster algebras coming from marked surfaces, while still allowing many results to be generalized from the acyclic case.

Commutative Algebra
Thursday, January 31, 2013, 3:00pm-4:00pm
3096 East Hall
Daniel Erman (University of Michigan)
Laurent Polynomials and Eulerian Numbers

Prompted by a question of Sturmfels, we show a surprising connection between the Eulerian numbers and Laurent polynomials whose powers have a zero constant term. We will discuss the proof, which involves multigraded commutative algebra and toric geometry, as well as several natural follow-up questions.

Commutative Algebra
Thursday, February 07, 2013, 3:00pm-4:00pm
3096 East Hall
Luis Nunez-Betancourt (University of Michigan)
Associated primes of local cohomology of flat extensions with regular fibers

In this talk, we will discuss the following question raised by Mel Hochster: let (R,m,K) be a local ring and S be a flat extension with regular closed fiber. Is the set of associated primes of $H^i_I(S)$ that contain mS finite for every ideal $I\subset S$ and every $i\in \mathbb{N}$? We will explore, using several tools from homological algebra, cases in which the answer is positive.

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Commutative Algebra
Thursday, February 14, 2013, 3:00pm-4:00pm
3096 East Hall
Mathias Lederer (UniversitÃ¤t Bielefeld)
Geometric Littlewood-Richardson rules

The ring of symmetric functions is the cohomology ring of Grassmannians. The Schur functions s_λ are a $\mathbb{Z}$-basis of it. These functions are indexed by partitions λ; the multiplicative structure of the ring is given by the Littlewood-Richardson coefficients appearing in $s_\lambda s_\mu = \sum c_{\lambda \mu}^\nu s_nu$. Vakil found a geometric way of determining the Littlewood-Richardson coefficients. Knutson generalized his method, thus also determining equivariant cohomology and K-theory of Grassmannians. We will study a deformation of the ring of symmetric functions which naturally appears in equivariant homology of Grassmannians. We will discuss a $\mathbb{Z}[t]$-basis of it, and sketch the way toward a Littlewood-Richardson rule for determining the ring structure. (Joint work with Allen Knutson.)

Commutative Algebra
Thursday, February 21, 2013, 3:00pm-4:00pm
3096 East Hall
Morgan Brown (University of Michigan)
Finite generation in characteristic 0 and characteristic p

One of the fundamental problems in birational geometry is to determine whether or not finite generation holds for the ring of sections $R(X,D)$ of a divisor D on a variety X. We will start by considering a specific case: Let I be the ideal of a monomial curve in $k[x,y,z]$, and let R be the symbolic Rees algebra. In general it is not known when these are finitely generated, but there are examples due to Goto, Nishida, and Watanabe, which are not finitely generated when k has characteristic 0 but are when k has positive characteristic.

Commutative Algebra
Thursday, February 28, 2013, 3:00pm-4:00pm
3096 East Hall
Jesse Burke (UCLA)
Graded matrix factorizations and complete intersections

In this talk I will describe how ideas of Orlov can be used to show that modules over a complete intersection ring are equivalent to graded matrix factorizations of the "universal intermediate hypersurface" of the ring. I will illustrate this with examples and show how the equivalence gives information on free resolutions over complete intersections.

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Commutative Algebra
Thursday, March 14, 2013, 3:00pm-4:00pm
3096 East Hall
Will Traves (US Naval Academy)
From Pascal's Theorem to Constructible Curves

When he was 16 years old, Blaise Pascal extended a famous geometric result due to Pappus (4th century A.D.). Pascal's theorem and Pappus's theorem have been the inspiration for a lot of nice mathematics. We'll review their results and extend their theorems to higher degree curves. I'll discuss connections to linkage and secant varieties, and I'll give a new theorem on elliptic curves. This is joint work with Mike Roth (Queen's University).

Commutative Algebra
Thursday, March 21, 2013, 3:00pm-4:00pm
3096 East Hall
Jenna Rajchgot (University of Michigan)
Doubly Universal Grobner bases

A universal Grobner basis of an ideal in a polynomial ring is a finite set of polynomials which is a (non-reduced, non-minimal) Grobner basis for every monomial order. In this talk, Iâ€™ll explain a way to generalize this notion from ideals in a polynomial ring to an ideal sheaf defining the universal family over a Hilbert scheme, and Iâ€™ll describe the form of such a universal Grobner basis. Iâ€™ll end by discussing an application to studying 1-dimensional torus orbits in a Hilbert scheme. This part is work in progress.
This is joint work with Mathias Lederer.

Commutative Algebra
Thursday, March 28, 2013, 3:00pm-4:00pm
3096 East Hall
Florian Enescu (Georgia State University)
On strong test ideals

The talk will discuss a couple of problems about strong test ideals in tight closure theory, and present a new class of such ideals related to algebra pairs.

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Commutative Algebra
Thursday, April 04, 2013, 3:00pm-4:00pm
3096 East Hall
Mel Hochster (University of Michigan)
Ideals and algebras generated by forms of degree at most 4 in polynomial rings

Michael Stillman raised the following question: given n homogeneous polynomials of degree at most d in a polynomial ring over a field, is there a bound on the projective dimension for the ideal they generate that depends on n,d and not on the number of variables? Hilbert proved that the number of variables is a bound. The talk will discuss joint work with Tigran Ananyan which answers this question affirmatively if the forms have degree at most 4, provided the characteristic of the field is not 2 or 3. Results of the following kind over an algebraically closed field play a key role: Given a vector space of quadratic forms of dimension 3, if no nonzero element is in the ideal generated by 27 linear forms, then the quotient by the ideal generated by the quadratic forms is a UFD. We can prove similar results up to degree 4 if the characteristic is not 2 or 3. I.e., for d at most 4, there are functions A(n,d) such that if o nonzero homogeneous element in the vector space spanned by at most n forms is in an ideal generated by A(n,d) elements of lower degree, then the quotient by the ideal generated by any subset of the forms is a unique factorization domain. We conjecture that such results hold in general, if the characteristic is 0 or greater than d.

Commutative Algebra
Thursday, April 11, 2013, 3:00pm-4:00pm
3096 East Hall
Diane Maclagan (University of Warwick)
Tropical Commutative Algebra

Tropical geometry studies ideals and varieties by via associating a polyhedral complex, called the tropical variety. One description of the tropical variety uses a modification of Grobner bases that takes the valuations of the coefficients into account. This variant has many of the good properties of standard Grobner bases, but can lead to much smaller Grobner bases. I will discuss how to compute these Grobner bases, which have been implemented for the p-adic valuation, and indicate what other commutative algebra information can be uncovered from the tropical approach to an ideal.