UNIVERSITY OF MICHIGAN
Department of Mathematics

Seminar & Events Bulletin: Algebraic Geometry

01-01-2013 to 06-30-2013

Wednesday, January 16, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Holly Krieger (UIC) *TBA* -- 3088 East Hall

Wednesday, January 23, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Tyler Foster (Yale) *Configuration operads via quiver Grassmannians* -- 3088 East Hall

Wednesday, January 30, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Brian Lehmann (Rice) *Big cycles and volume functions* -- 3088 East Hall

Wednesday, February 06, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Daniel Erman (UM) *Semiample Bertini theorems over finite fields* -- 3088 East Hall

Wednesday, February 13, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Sam Payne (Yale) *Tropicalization of the moduli space of curves* -- 3088 East Hall

Wednesday, February 20, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Gabi Farkas (Berlin) *Syzygies of torsion bundles and the geometry of the level l modular variety over M_g* -- 3088 East Hall

Wednesday, February 27, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Jun Li (Stanford) *Categorification of DT invariants and GV numbers* -- 3088 East Hall

Wednesday, March 13, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Anton Khoroshkin (Stonybrook) *Syzygies via Lie algebra cohomology* -- 3088 East Hall

Wednesday, March 20, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Morgan Brown (UM) *The McKay correspondence* -- 3088 East Hall

Wednesday, March 27, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- John Lesieutre (MIT) *A divisor with non-closed diminished base locus* -- 3088 East Hall

Wednesday, April 10, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Paolo Aluffi (FSU) *Segre classes of monomial subschemes* -- 3088 East Hall

Thursday, April 11, 2013	
4:00pm-5:00pm	**Algebraic Geometry** -- Johannes Nicaise (Leuven) *The Kontsevich-Soibelman skeleton of a degeneration of Calabi-Yau varieties* -- 3088 East Hall

Seminar & Events Bulletin: Algebraic Geometry

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Tuesday, April 16, 2013	
3:00pm-4:00pm	**Algebraic Geometry** -- Richard Thomas (Imperial College) *The GÃ¶ttsche conjecture* -- 1360 East Hall

Wednesday, April 17, 2013	
4:00pm-6:00pm	**Algebraic Geometry** -- Richard Thomas (Imperial College) *Stable maps, ideal sheaves and the MNOP conjecture* -- 3088 East Hall

Thursday, April 18, 2013	
3:00pm-4:00pm	**Algebraic Geometry** -- Richard Thomas (Imperial College) *Stable pairs* -- 3088 East Hall

Friday, April 19, 2013	
4:00am-5:00am	**Algebraic Geometry** -- Richard Thomas (Imperial College) *BPS invariants* -- 4088 EH

Thursday, May 16, 2013	
12:00am-12:00am	**Algebraic Geometry** -- () *Conference in Algebraic Geometry* -- TBA

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Abstracts

Algebraic Geometry
Wednesday, January 16, 2013, 4:00pm-6:00pm
3088 East Hall
Holly Krieger (UIC)
TBA

Algebraic Geometry
Wednesday, January 23, 2013, 4:00pm-6:00pm
3088 East Hall
Tyler Foster (Yale)
Configuration operads via quiver Grassmannians

The moduli spaces of stable marked rational curves form an operad that plays an important role in the theory of quantum cohomology. In 2006, Chen, Gibney, and Krashen introduced families of moduli spaces closely related to Fulton-MacPherson compactifications, indexed by positive integers d. For each value of d, the corresponding family forms an operad. When d=1, this family recovers the operad of stable marked rational curves. In this talk, I will discuss Chen-Gibney-Krashen spaces, and then introduce a general formalism for constructing abstract operads from certain functors. The operads so obtained contain Chen-Gibney-Krashen operads, along with much else.

Algebraic Geometry
Wednesday, January 30, 2013, 4:00pm-6:00pm
3088 East Hall
Brian Lehmann (Rice)
Big cycles and volume functions

The volume of a divisor is an important invariant measuring the "positivity" of its numerical class. I will discuss an analogous construction for cycles of arbitrary codimension. In particular, this yields geometric characterizations of big cycle classes modeled on the well-known criteria for divisor and curve classes.

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Algebraic Geometry
Wednesday, February 06, 2013, 4:00pm-6:00pm
3088 East Hall
Daniel Erman (UM)
Semiample Bertini theorems over finite fields

For a smooth projective variety over a finite field, Poonenâ€™s Bertini Theorem computes the probability that a high degree hypersurface section of that variety will be smooth. We prove a semiample generalization of Poonen's result. This is joint with Melanie Matchett Wood.

Algebraic Geometry
Wednesday, February 13, 2013, 4:00pm-6:00pm
3088 East Hall
Sam Payne (Yale)
Tropicalization of the moduli space of curves

Tropical geometry allows a systematic study of algebraic curves over valued fields in terms of the marked dual graphs of special fibers of models of the curve over the valuation ring. In the past several years, a number of researchers, including Caporaso, Gathmann, Kozlov, Mikhalkin, and their collaborators, have introduced and studied moduli spaces for these marked graphs, which are often called tropical curves, and estabilshed various analogies to moduli spaces of curves. I will present work that explains and extends these analogies, canonically and functorially, by applying a new generalized tropicalization map for toroidal Deligne-Mumford stacks to the moduli space of stable curves. Berkovich spaces appear in the construction of this new tropicalization map in a natural and elementary way, but no tropical or nonarchimedean analytic background is assumed. This is joint work with D. Abramovich and L. Caporaso.

Algebraic Geometry
Wednesday, February 20, 2013, 4:00pm-6:00pm
3088 East Hall
Gabi Farkas (Berlin)
Syzygies of torsion bundles and the geometry of the level l modular variety over M_g

In joint work with Chiodo, Eisenbud and Schreyer, we formulate, and in some cases prove, three statements concerning the purity of the resolution of various rings one can attach to a generic curve of genus g and a torsion point of order l in its Jacobian. These statements can be viewed as analogues of Green's Conjecture and we verify them computationally for bounded genus. We then compute the cohomology class of the corresponding non-vanishing locus in the moduli space R_{g,l} of twisted level l curves of genus g and use this to derive results about the birational geometry of R_{g, l}. For instance, we prove that R_{g,3} is a variety of general type when g>11. I will also discuss the surprising failure of the Prym-Green Conjecture for genera which are powers of 2.

Algebraic Geometry
Wednesday, February 27, 2013, 4:00pm-6:00pm
3088 East Hall
Jun Li (Stanford)
Categorification of DT invariants and GV numbers

DT invariants are degrees of the virtual cycles of the moduli of sheaves on Calabi-Yau threefolds. Behrend's function allows to reconstruct these invariants via weighted Euler numbers, thus can define DT-invariants motivically. A categorification of DT invariants search for perverse sheaves on these moduli spaces so the Behrend function is the local Euler numbers of cohomology sheaves of these perverse sheaves. In a joint work with YH Kiem, we construct such perverse sheaves, with MHM structures. As a corollary, we define GV numbers via a double sl2 representations on 2-branes.

Algebraic Geometry
Wednesday, March 13, 2013, 4:00pm-6:00pm
3088 East Hall
Anton Khoroshkin (Stonybrook)
Syzygies via Lie algebra cohomology

I will explain the isomorphism between the space of syzygies of arbitrary projective quadratic embeddings and certain Lie algebra cohomology. The isomorphism is based on Koszul duality theory. As an illustration we calculate syzygies of the Plucker embedding of the Grassmannian of 2-dimensional planes.

Talk is based on a joint work with A.Gorodentsev, A.Rudakov math.arxiv:0602316

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Algebraic Geometry
Wednesday, March 20, 2013, 4:00pm-6:00pm
3088 East Hall
Morgan Brown (UM)
The McKay correspondence

Let G be a subgroup of $SL_n(\mathbb{C})$. The classical McKay correspondence relates the representation theory of G with the structure of a minimal resolution of $\mathbb{C}^n/G$. For $n=3$, Bridgeland, King, and Reid used categorical techniques to show that $\mathbb{C}^n/G$ has a distinguished crepant resolution G-Hilb.

In the first half I will demonstrate a technique due to Craw and Reid for constructing G-Hilb in the toric case (when G is abelian). In the second half I will introduce derived equivalences and their relation to birational geometry, with the 3 dimensional McKay correspondence as a motivating example.

Algebraic Geometry
Wednesday, March 27, 2013, 4:00pm-6:00pm
3088 East Hall
John Lesieutre (MIT)
A divisor with non-closed diminished base locus

I will explain the construction of a pseudoeffective $\mathbb R$-divisor D on the blow-up of $\mathbb P^3$ at nine very general points which has negative intersections with a Zariski dense set of curves. The diminished base locus $\mathbf B_-(D) = \bigcup_{\text{A ample}} \mathbf B(D+A)$ of D is not closed, and D does not admit a Zariski decomposition in even a very weak sense. By a similar method, I'll exhibit an $\mathbb R$-divisor which is nef on very general fibers of a family, but fails to be nef over countably many prime divisors in the base. I'll also discuss some related issues for divisors on Calabi-Yau threefolds.

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Algebraic Geometry
Wednesday, April 10, 2013, 4:00pm-6:00pm
3088 East Hall
Paolo Aluffi (FSU)
Segre classes of monomial subschemes

Segre classes are fundamental intersection-theoretic invariants: many problems in enumerative geometry may be reduced to computations of Segre classes, and basic invariants such as Milnor numbers and classes may be expressed in terms of Segre classes. We propose a formula computing the Segre class of an arbitrary monomial subscheme, and prove this formula in several representative cases. The formula is reminiscent of intersection computations in terms of mixed volumes of polytopes and convex bodies as in the classical Bernstein's theorem and more recent work of Kaveh-Khovanskii, Huh, and others.

Algebraic Geometry
Thursday, April 11, 2013, 4:00pm-5:00pm
3088 East Hall
Johannes Nicaise (Leuven)
The Kontsevich-Soibelman skeleton of a degeneration of Calabi-Yau varieties

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Algebraic Geometry
Tuesday, April 16, 2013, 3:00pm-4:00pm
1360 East Hall
Richard Thomas (Imperial College)
The GÃ¶ttsche conjecture

I will describe a classical problem going back to 1848 (Steiner, Cayley, Salmon,...) and a solution using simple techniques that one would never have thought of without ideas coming from string theory (Gromov-Witten invariants, BPS states) and modern geometry (the Maulik-Nekrasov-Okounkov-Pandharipande conjecture). In generic families of curves C on a complex surface S, nodal curves - those with the simplest possible singularities - appear in codimension 1. More generally those with d nodes occur in codimension d. In particular a d-dimensional linear family of curves should contain a finite number of such d-nodal curves. The classical problem - at least in the case of S being the projective plane - is to determine this number. The G Ìˆottsche conjecture states that the answer should be topological, given by a universal degree d polynomial in the four numbers (C Â· C), (c1(S) Â· C), (c1(S)2), and c2(S).

This was proved recently by Yu-Jong Tzeng. I will explain a simpler proof which was joint work with Martijn Kool and Vivek Shende. The treatment will be very low-tech; I wonâ€™t assume any prior knowledge. The main tool is Euler characteristics (which I will also explain).

Algebraic Geometry
Wednesday, April 17, 2013, 4:00pm-6:00pm
3088 East Hall
Richard Thomas (Imperial College)
Stable maps, ideal sheaves and the MNOP conjecture

I will gently review two moduli spaces of curves in algebraic varieties, their similarities, differences, and a little about how ones obtains invariants from them. (a) Stable maps, or parameterised curves. (b) Subschemes or unparamet

Algebraic Geometry
Thursday, April 18, 2013, 3:00pm-4:00pm
3088 East Hall
Richard Thomas (Imperial College)
Stable pairs

I will explain a third moduli space and the corresponding invariants, and some of their advantages over the previous two.

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Algebraic Geometry
Friday, April 19, 2013, 4:00am-5:00am
4088 EH
Richard Thomas (Imperial College)
BPS invariants

BPS invariants, conjectured to exist by Gopaukmar-Vafa, would give a 4th (and in many ways superior) way to enumerate curves. I will explain how stable pairs give an approach to them.

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