## Monday, February 05, 2018

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<thead>
<tr>
<th>Time</th>
<th>Seminar</th>
<th>Location</th>
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<tbody>
<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Complex Analysis, Dynamics and Geometry</strong> -- Steven Damelin (Math Reviews) <em>On the maximum modulus of weighted polynomials in the plane, zero distribution and zero location of weighted extremal polynomials.</em> -- 3096 East Hall</td>
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<tr>
<td>4:00pm-6:00pm</td>
<td><strong>Geometry &amp; Physics</strong> -- Adrien Sauvaget (Paris VI) <em>Volumes of strata of differentials and intersection theory on moduli spaces of curves.</em> -- 4096 East Hall</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Student Combinatorics Seminar</strong> -- Bob Lutz (University of Michigan) <em>Electrical networks and hyperplane arrangements.</em> -- 3866 East Hall</td>
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<td>4:10pm-5:30pm</td>
<td><strong>Group, Lie and Number Theory</strong> -- David Zywina (Cornell University) <em>Computing l-adic monodromy groups.</em> -- 4088 East Hall</td>
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## Tuesday, February 06, 2018

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<td><strong>Teaching Mathematics</strong> -- Discussion () <em>Learning Community on Inclusive Teaching Session 1.</em> -- 4866 East Hall</td>
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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Student Geometry/Topology</strong> -- Mark Greenfield (University of Michigan) <em>An introduction to symmetric spaces.</em> -- 3866 East Hall</td>
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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Student Representation Theory</strong> -- Andy Odesky (University of Michigan) <em>An IBL session on group algebras.</em> -- 1866 East Hall</td>
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<tr>
<td>4:10pm-5:00pm</td>
<td><strong>Colloquium Series</strong> -- Qing Han (Notre Dame University) <em>Isometric Embedding of 2-dim Riemannian Manifolds in Euclidean 3-Space.</em> -- 1360 East Hall</td>
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## Wednesday, February 07, 2018

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<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Student Arithmetic</strong> -- Jason Liang (UM) <em>Elliptic Curves with a Given J-Invariant.</em> -- 1866 East Hall</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Financial/Actuarial Mathematics</strong> -- Thomas Kruse (University of Duisburg-Essen) <em>Multilevel Picard approximations for high-dimensional nonlinear parabolic partial differential equations.</em> -- 1360 East Hall</td>
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<td><strong>RTG Seminar on Geometry, Dynamics and Topology</strong> -- Didac Martinez-Granado (Indiana University) <em>Simultaneous uniformization and polynomial matings.</em> -- 3866 East Hall</td>
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<td><strong>Algebraic Geometry</strong> -- David Anderson (Ohio-State University) <em>Finiteness in quantum K-theory of flag varieties.</em> -- 4096 East Hall</td>
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## Thursday, February 08, 2018

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<td><strong>Topology</strong> -- Lei Chen (University of Chicago) <em>From point-picking to sections of surface bundles.</em> -- 1866 East Hall</td>
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<td><strong>Commutative Algebra</strong> -- Daniel Smolkin (University of Utah) <em>Subadditivity and Symbolic Powers.</em> -- B735 East Hall</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Student Dynamics</strong> -- Salman Siddiqi (University of Michigan) <em>Decay of correlations and central limit theorems in dynamical systems.</em> -- 1866 East Hall</td>
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<td>4:10pm-5:30pm</td>
<td><strong>Preprint Algebraic Geometry Seminar</strong> -- Igor Dolgachev (UM) <em>Non-liftable Calabi-Yau varieties in characteristic p (following Achinger-Zdanowicz).</em> -- 2866 East Hall</td>
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<td>5:00pm-6:00pm</td>
<td><strong>Representation Stability</strong> -- Eric Ramos (University of Michigan) <em>Configuration spaces of graphs and representation stability.</em> -- 3866 East Hall</td>
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<tr>
<td>10:00am-11:00am</td>
<td><strong>Symplectic Reading Group</strong> -- Dan Burns (UM) <strong>Symplectic Rigidity and Quantum Mechanics</strong> -- 1360 East Hall</td>
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<td><strong>Student Homotopy Theory</strong> -- Ruian Chen (University of Michigan) <strong>The first thing to know about Perverse Sheaves</strong> -- 1360 East Hall</td>
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<td>3:00pm-4:00pm</td>
<td><strong>Applied Interdisciplinary Mathematics (AIM)</strong> -- Phil Roe (University of Michigan, Aerospace Engineering) <strong>A new approach to numerical conservation laws</strong> -- 1084 East Hall</td>
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<td>3:00pm-4:00pm</td>
<td><strong>Geometry</strong> -- Krystal Taylor (OSU) <strong>Interior, Dimension, and Measure of Algebraic Sums of Fractal Sets and Curves via Fourier analysis and other techniques</strong> -- 3866 East Hall</td>
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<td>3:10pm-4:00pm</td>
<td><strong>Student Algebraic Geometry</strong> -- Haoyang Guo (UM) <strong>Spreading Out</strong> -- 3096 East Hall</td>
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<td>4:10pm-5:30pm</td>
<td><strong>Student AIM Seminar</strong> -- Emanuel Gull (University of Michigan) <strong>Modern Software Practices</strong> -- 1084 East Hall</td>
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<td><strong>Combinatorics</strong> -- Eric Ramos (U. Michigan) <strong>Families of nested graphs with compatible symmetric-group actions</strong> -- 4088 East Hall</td>
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Complex Analysis, Dynamics and Geometry  
Monday, February 05, 2018, 4:00pm-5:00pm  
3096 East Hall  
Steven Damelin (Math Reviews)  

*On the maximum modulus of weighted polynomials in the plane, zero distribution and zero location of weighted extremal polynomials.*

For a closed, strongly regular subset of the complex plane $E$ of positive capacity and a non negative continuous weight $w$ on $E$ satisfying that the set where $w$ is positive is of positive capacity, we prove that any weighted polynomial $P_n w^n$ of degree at most $n$, $n \geq 1$ satisfies that all points for which it attains its maximum on $E$ live in the support of the weight $w$. If $E$ is unbounded, we assume that $w$ is of sufficient fast decrease with large argument. Examples are given to show that our requirements on $E$ cannot in general be relaxed. As a consequence of this result we show that if $E$ is a real interval of positive length, and $p$ is a fixed positive number, we prove a necessary and sufficient condition which ensures that the $L_p$ norm of $P_n w^n$ on $E$ is in an $n$th root sense, controlled by a corresponding discrete $L_p$ Holder norm of $P_n w^n$ on a certain well separated admissible triangular scheme of points $E_n$, $n \geq 1$ of $E$. When $P_n w^n$ is extremal on $E_n$, this condition implies results on zero distribution and zero location of $P_n w^n$ on $E$.

Geometry & Physics  
Monday, February 05, 2018, 4:00pm-6:00pm  
4096 East Hall  
Adrien Sauvaget (Paris VI)  

*Volumes of strata of differentials and intersection theory on moduli spaces of curves.*

The Hodge bundle is the moduli space parametrizing Riemann surfaces endowed with a holomorphic differential. This space is stratified according to the set of orders of zeros of the differentials. In the 80's H. Masur and W. Veech defined two numerical invariants of strata of differentials: the volume and the Siegel-Veech constant. Based on numerical experiments, A. Eskin and A. Zorich proposed a series of conjectures for the large genus asymptotics of these invariants. We will explain how to compute the volumes of strata in terms of Hodge integrals on moduli spaces of curves and how to deduce some asymptotic properties from this.
Student Combinatorics Seminar
Monday, February 05, 2018, 4:00pm-5:00pm
3866 East Hall
Bob Lutz (University of Michigan)
Electrical networks and hyperplane arrangements

What extra information is bestowed on a graph when we assign real values to some vertices? This is the question posed by a linear resistor network with fixed boundary voltages. We model such a network by an "affine slice" of the real graphic hyperplane arrangement. This slice inherits the combinatorics of the underlying network, which we describe in detail. We also show how the bounded chambers of the slice parameterize the harmonic functions on the network. Time permitting, we (briefly!) discuss a connection to mathematical physics. No previous knowledge of electrical networks is assumed.

Group, Lie and Number Theory
Monday, February 05, 2018, 4:10pm-5:30pm
4088 East Hall
David Zywina (Cornell University)
Computing l-adic monodromy groups

Fix a prime $l$ and an abelian variety $A$ over a number field. The Galois action on the torsion points of $A$ can be described by an $l$-adic Galois representation. The Zariski closure $G$ of its image is called the $l$-adic monodromy group of $A$. The group $G$ encodes a lot of the arithmetic/geometry of $A$. For example, the Sato-Tate distribution of $A$ can conjecturally be determined from $G$.

We will discuss approaches to studying and computing these monodromy groups.

Teaching Mathematics
Tuesday, February 06, 2018, 12:00pm-1:30pm
4866 East Hall
Discussion ()
Learning Community on Inclusive Teaching Session 1.

This is the first meeting of the U(M) Math Learning Community on Inclusive Teaching. In this session we will be discussing a number of short background readings on inclusive teaching of mathematics. The readings and information about the session are available at http://www.math.lsa.umich.edu/~glarose/dept/teaching/lcit.html. We encourage participants to have read those in advance, but the discussion should be of interest even if that is not the case.
Symmetric spaces are extremely special Riemannian manifolds which may be studied from many perspectives. In this talk, we will introduce a few major aspects of the theory of symmetric spaces, primarily with a geometric emphasis. The focus will be on intuitively understanding definitions and examples, rather than precise statements and proofs of classical theorems.

Because one can never know too much representation theory! We will spend the hour getting to know the structure of group algebras a little bit better. There will be useful problems for all levels. Some topics: characterization of permutation representations, generalizations of Frobenius reciprocity, examples in positive characteristic, the number of irreducible representations defined over not-necessarily-algebraically-closed fields, the Brauer group, and more.

It is a classical problem to study whether any 2-dimensional Riemannian manifolds admit isometric embedding in the 3-dimensional Euclidean space. There are two versions of this problem, the local version and the global version. The local version was presented by Schlaefl in 1873 and is still open. In this talk, we review both versions of the problem and present some recent results.

I will talk about the classification of elliptic curves over a number field K with a given j-invariant.
Financial/Actuarial Mathematics  
Wednesday, February 07, 2018, 4:00pm-5:00pm  
1360 East Hall  
Thomas Kruse (University of Duisburg-Essen)  
*Multilevel Picard approximations for high-dimensional nonlinear parabolic partial differential equations*

In this talk we present a family of new approximation methods for high-dimensional PDEs and BSDEs. A key idea of our methods is to combine multilevel approximations with Picard fixed-point approximations. Thereby we obtain a class of multilevel Picard approximations. Our error analysis proves that for semi-linear heat equations, the computational complexity of one of the proposed methods is bounded by  
\[ O(d, \varepsilon^{-(4+\delta)}) \]  
for any $\delta > 0$, where $d$ is the dimensionality of the problem and $\varepsilon \in (0,\infty)$ is the prescribed accuracy. We illustrate the efficiency of one of the proposed approximation methods by means of numerical simulations presenting approximation accuracy against runtime for several nonlinear PDEs from physics (such as the Allen-Cahn equation) and financial engineering (such as derivative pricing incorporating default risks) in the case of $d=100$ space dimensions.

RTG Seminar on Geometry, Dynamics and Topology  
Wednesday, February 07, 2018, 4:00pm-5:30pm  
3866 East Hall  
Didac Martinez-Granado (Indiana University)  
*Simultaneous uniformization and polynomial matings.*

We continue our study of the Sullivan dictionary between Kleinian groups and rational maps.

Algebraic Geometry  
Wednesday, February 07, 2018, 4:10pm-5:30pm  
4096 East Hall  
David Anderson (Ohio-State University)  
*Finiteness in quantum K-theory of flag varieties*

A quantum product on the K-theory of a variety was defined by Givental, deforming the usual tensor product just as quantum cohomology deforms the cup product. In contrast to cohomology, it is far from obvious that the product is finite in the deformation parameters: from the definition, contributions from curves of arbitrarily high degree appear. For Grassmannians - or more generally, cominuscule homogeneous varieties - Buch, Chaput, Mihalcea, and Perrin showed the product is finite, by carrying out a detailed study of the Kontsevich space of stable maps.

I will describe work with Linda Chen and Hsian-Hua Tseng in which we show that the quantum K-theory is finite for all flag varieties G/B of simply laced type. Our methods are rather different, taking advantage of properties of the K-theoretic J-function.
**Topology**  
**Thursday, February 08, 2018, 3:00pm-4:00pm**  
1866 East Hall  
Lei Chen (University of Chicago)  
*From point-picking to sections of surface bundles*  

Given any n points on a manifold, how can we systematically and continuously find a new point? What if we ask them to be distinct? In this talk, I will try to answer this question in surfaces. Then I will connect this question to sections of surface bundles. The slogan is "there is no center of mass on closed hyperbolic surfaces".

**Commutative Algebra**  
**Thursday, February 08, 2018, 3:00pm-4:00pm**  
B735 East Hall  
Daniel Smolkin (University of Utah)  
*Subadditivity and Symbolic Powers*  

An important problem in commutative algebra is studying the relationship between symbolic and ordinary ideals. One striking result in this direction was found by Ein-Lazarsfeld-Smith, who showed that for regular rings in characteristic 0, the dn-th symbolic power of any ideal is contained in the n-th ordinary power of that ideal, where d is the dimension of the ring. Their method proved to be quite powerful, and was adapted to the positive characteristic setting by Hara and the mixed characteristic setting by Ma and Schwede.

In this talk, we will discuss an approach to extending the Ein-Lazarsfeld-Smith method to the non-regular setting by coming up with a new subadditivity formula for test ideals. Recent joint work with Javier Carvajal-Rojas shows that this approach works for segre products of polynomial rings. Afterwards, we will talk about how applying this approach to any toric variety reduces to solving a certain combinatorial problem.

**Student Dynamics**  
**Thursday, February 08, 2018, 4:00pm-5:00pm**  
1866 East Hall  
Salman Siddiqi (University of Michigan)  
*Decay of correlations and central limit theorems in dynamical systems*  

This is a continuation of my talk last week. I will explain, with some motivation, how to obtain exponential decay of correlations and central limit theorems in dynamical systems by studying the spectrum of an associated transfer operator. This talk should be relatively accessible, and I will not assume anything beyond basic measure theory.

**Preprint Algebraic Geometry Seminar**  
**Thursday, February 08, 2018, 4:10pm-5:30pm**  
2866 East Hall  
Igor Dolgachev (UM)  
*Non-liftable Calabi-Yau varieties in characteristic p (following Achinger-Zdanowicz)*
Representation Stability  
**Thursday, February 08, 2018, 5:00pm-6:00pm**  
3866 East Hall  
Eric Ramos (University of Michigan)  
*Configuration spaces of graphs and representation stability*

In this talk, we give an overview of the state of the art in the study of graph configuration spaces. We follow this by exploring what the tools of representation stability, and other related techniques from asymptotic algebra, can tell us about these spaces.

Symplectic Reading Group  
**Friday, February 09, 2018, 10:00am-11:00am**  
1360 East Hall  
Dan Burns (UM)  
*Symplectic Rigidity and Quantum Mechanics*

We first finish the recap of earlier parts of Polterovich and Rosen. Then we begin an overview of some of the relations of "hard" symplectic geometry and quantum mechanics. The reading is Polterovich and Rosen, chap 9 [https://umich.app.box.com/file/273095367082] and

1. Quantum footprints of symplectic rigidity  
2. Symplectic rigidity and quantum mechanicsics

Both of these are in the Box file: https://umich.app.box.com/folder/45933260692

Student Homotopy Theory  
**Friday, February 09, 2018, 12:10pm-2:00pm**  
1360 East Hall  
Ruian Chen (University of Michigan)  
*The first thing to know about Perverse Sheaves*

According to Beilinson, Bernstein and Deligne, "perverse sheaves are neither sheaves nor perverse"; apparently this is the first thing one should know about perverse sheaves (MacPherson). In this talk, we will see precisely what this quote means: these objects in the constructible derived category of sheaves can be perceived as local systems with singularities, and they generalize the intersection cohomology, which make them natural objects of study on singular spaces. As a concrete example, we will examine simple perverse sheaves on a smooth complex algebraic curve. Time permitting, we will explain Deligne's construction, which allows calculation of intersection complex by induction on strata.
The numerical solution of hyperbolic conservation laws, either by Finite Volume or Finite Element methods, rests largely on representing the solution by smooth basis functions within each element, leaving discontinuities at the boundaries. The discontinuities are resolved by solving one-dimensional Riemann problems. The basic idea was introduced by Godunov in 1959, and since then has been accepted as a natural, almost inevitable, approach. In this talk, the representations will be continuous and no Riemann problems will be solved. The emphasis will be on distinctive handling of the advective and non-advective disturbances, with initial reference to the advective-acoustic structure of the Euler equations. In the usual approach, this distinction is not given prominence, because in one dimension the advective and acoustic modes behave very similarly. Here, we recognize the considerable differences found in higher dimensions. Advection is dealt with by semi-Lagrangian Streamline tracing, and acoustics by adapting Poisson's solution to the Initial-Value Problem for the scalar wave equation. These elements are combined to give a third-order accurate, fully explicit, maximally stable and conservative method. Initial experiments suggest that it provides accuracy comparable to other high-order methods at substantially reduced cost.

Geometry
Friday, February 09, 2018, 3:00pm-4:00pm
3866 East Hall
Krystal Taylor (OSU)

*Interior, Dimension, and Measure of Algebraic Sums of Fractal Sets and Curves via Fourier analysis and other techniques*

It is a time honored and classic problem to ask for the properties of the algebraic sum $A+B$ given sets $A$ and $B$ in the Euclidean plane. We focus on the case when $\Gamma$ is a piecewise $C^2$ curve (such as the unit circle). There is a natural guess what the size (Hausdorff dimension, Lebesgue measure) of $A+\Gamma$ should be. We verify this under some natural assumptions. We also address the more difficult question: under which condition does the set $A+\Gamma$ have non-empty interior? The results have some surprising consequences for distance sets: $\Delta_x(A) := \{|x-y|: y \in A\}$, where $x$ is a fixed point and $A$ is a fractal subset of $\mathbb{R}^d$ of sufficient Hausdorff dimension. The relation between structure within a fractal set (as measured by sufficient Hausdorff dimension or by the existence of geometric configurations within) and the Fourier decay of a measure supported on said set is implicit.
Spreading out is a standard technique in algebraic geometry. It allows us to relate geometric statements over a field of characteristic zero to the analogous results over more general bases. Moreover, spreading out arises in many interesting questions in arithmetic geometry (for example, the study of integral models). In this talk, we will introduce the procedure of spreading out and its properties. As an application, we will use the technique to show a theorem of Ax, which roughly states that any injective endomorphism of an affine variety is bijective. This talk will be accessible to anyone who is taking or has taken 632.

Student AIM Seminar
Friday, February 09, 2018, 4:10pm-5:30pm
1084 East Hall
Emanuel Gull (University of Michigan)
Modern Software Practices

This talk is designed to introduce and encourage a broad range of modern software practices. Topics include IDEs, unit testing, test driven development, version control, documentation generation, and autotools. These tools and practices enable teams of people to work together on projects with full confidence that one member's contributions do not interfere with the functionality of others'. While these topics are typically emphasized in math, physics, or chemistry programs, they are essential to the modern large scale scientific computing projects. With this talk I hope to show you the power behind these practices and point you in the right direction to learn more. Developing these skills now will help you with your research as you collaborate and your projects grow and prepare you for joining future team projects that are already implementing these practices.

Please note this talk will be longer than usual. You are welcome to come to any portion of the event.
Combinatorics  
Friday, February 09, 2018, 4:10pm-5:00pm  
4088 East Hall  
Eric Ramos (U. Michigan)  
Families of nested graphs with compatible symmetric-group actions

For fixed positive integers $n$ and $k$, the Kneser graph has vertices labeled by $k$-element subsets of \{1,2,\ldots,n\} and edges between disjoint sets. Keeping $k$ fixed and allowing $n$ to grow, one obtains a family of nested graphs, each of which is acted on by a symmetric group in a way which is compatible with all of the other actions. In this paper, we provide a framework for studying families of this kind using the FI-module theory of Church, Ellenberg, and Farb, and show that this theory has a variety of asymptotic consequences for such families of graphs. These consequences span a range of topics including enumeration, concerning counting occurrences of subgraphs, topology, concerning Hom-complexes and configuration spaces of the graphs, and algebra, concerning the changing behaviors in the graph spectra.