**Weekly Seminar & Events Bulletin**  
February 7th, 2021 - February 13th, 2021

### Monday, February 08, 2021

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Details</th>
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<tbody>
<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Algebraic Topology</strong> -- Jeremy Hahn (MIT)</td>
<td>Redshift for truncated Brown-Peterson spectra -- online Virtual</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Integrable Systems and Random Matrix Theory</strong> -- Elliot Blackstone (KTH)</td>
<td>Large gap asymptotics for Airy and Bessel kernel determinants -- Zoom Meeting: 9161739235 Passcode: 651935 Virtual</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Midwest Dynamics and Group Actions</strong> -- Serge Cantat (University of Rennes)</td>
<td>Stationary measures on real projective surface -- Virtual</td>
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<tr>
<td>4:00pm-4:50pm</td>
<td><strong>RTG Seminar on Number Theory</strong> -- Liyang Yang (Caltech)</td>
<td>Central $L$-values on $U(2,1) \times U(1,1)$, Nonvanishing and Subconvexity -- Virtual</td>
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<td>5:00pm-6:00pm</td>
<td><strong>Student Analysis</strong> -- Ilya Marchenko (Notre Dame)</td>
<td>Regularity of Singular Sets of Solutions to Elliptic Equations -- Virtual</td>
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<td><strong>Faculty Spotlight</strong> -- Bieri and Wu ()</td>
<td>PDE --</td>
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<tr>
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<td><strong>Teaching Mathematics</strong> -- LCIT Discussion ()</td>
<td>Learning Community on Inclusive Teaching Discussion -- Virtual</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Colloquium Series</strong> -- Jordan Ellenberg (University of Wisconsin)</td>
<td>Beyond rank -- Virtual</td>
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<td>5:00pm-6:00pm</td>
<td><strong>Complex Analysis, Dynamics and Geometry</strong> -- InSung Park (Indiana University)</td>
<td>Julia sets with Ahlfors-regular conformal dimension one -- Virtual</td>
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<td><strong>Student Combinatorics</strong> -- Shelby Cox ()</td>
<td>Combinatorial Aspects of June Huh's thesis -- Virtual</td>
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<td><strong>Financial/Actuarial Mathematics</strong> -- Qingshuo Song (WPI)</td>
<td>Gradient estimate of HJB and its applications in Graphon Mean Field Game -- Virtual</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Algebraic Geometry</strong> -- Christian Sevenheck (TU Chemnitz)</td>
<td>Free divisors, $V$-filtration and Hodge ideals</td>
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<td>4:00pm-5:30pm</td>
<td><strong>RTG Seminar on Geometry, Dynamics and Topology</strong> -- Asaf Katz (U Michigan)</td>
<td>Gaps statistics and ergodic theory -- <a href="https://umich.zoom.us/j/92258297975">https://umich.zoom.us/j/92258297975</a> East Hall</td>
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### Thursday, February 11, 2021

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<td><strong>Topology</strong> -- Zachary Himes (Purdue University)</td>
<td>Secondary homological stability and periodic homological stability for unordered configuration spaces -- Virtual</td>
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<td><strong>Arithmetic Geometry Learning</strong> -- Shizhang Li ()</td>
<td>$t$-structures and recollement -- East Hall</td>
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<tr>
<td>2:00pm-3:00pm</td>
<td><strong>Student Commutative Algebra</strong> -- Sridhar Venkatesh ()</td>
<td>$F$-singularities -- Virtual</td>
</tr>
<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Applied Interdisciplinary Mathematics (AIM)</strong> -- Will Clark (Cornell University)</td>
<td>Geometry of Impact and Nonholonomic Systems -- (Zoom) East Hall</td>
</tr>
<tr>
<td>3:00pm-4:00pm</td>
<td><strong>Combinatorics</strong> -- Sunita Chepuri (University of Michigan)</td>
<td>$T$-paths for Graph LP Algebras -- Virtual</td>
</tr>
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<td>3:00pm-4:00pm</td>
<td><strong>Student Algebraic Geometry</strong> -- Michael Mueller (UM)</td>
<td>Moduli of stable curves and curve counting -- Virtual</td>
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<td>4:00pm-5:30pm</td>
<td><strong>Preprint Algebraic Geometry</strong> -- James Hotchkiss ()</td>
<td>de Jong: The period-index problem for the Brauer group of an algebraic surface (part II) -- East Hall</td>
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Abstracts for the week of February 7th, 2021 - February 13th, 2021

**Algebraic Topology**  
**Monday, February 08, 2021, 3:00pm-4:00pm**  
online Virtual  
Jeremy Hahn (MIT)  
*Redshift for truncated Brown-Peterson spectra*

I will explain work, joint with Dylan Wilson, about the algebraic K-theory of truncated Brown-Peterson spectra.

**Integrable Systems and Random Matrix Theory**  
**Monday, February 08, 2021, 4:00pm-5:00pm**  
Zoom Meeting: 91617339235       Passcode: 651935 Virtual  
Elliot Blackstone (KTH)  
*Large gap asymptotics for Airy and Bessel kernel determinants*

We discuss recent results on large multi-gap expansions for the Airy and Bessel kernel determinants. A novelty is the use of Birkhoff's ergodic theorem.

**Midwest Dynamics and Group Actions**  
**Monday, February 08, 2021, 4:00pm-5:00pm**  
Virtual  
Serge Cantat  (University of Rennes)  
*Stationary measures on real projective surface*

Consider a real projective surface $X(\mathbb{R})$, and a group $\Gamma$ acting by algebraic diffeomorphisms on $X(\mathbb{R})$. If $\nu$ is a probability measure on $\Gamma$, one can randomly and independently choose elements $f_j$ in $\Gamma$ and look at the random orbits $x, f_1(x), f_2(f_1(x)), \ldots$. How do these orbits distribute on the surface? This is directly related to the classification of stationary measures on $X(\mathbb{R})$.

I will describe recent results on this problem, all obtained in collaboration with Romain Dujardin. The main ingredients will be ergodic theory, notably the work of Brown and Rodriguez-Hertz, algebraic geometry, and complex analysis. Concrete geometric examples will be given.

Zoom link: https://iu.zoom.us/j/661711533?pwd=RTFVTjMrQ1pYTCTlZzlvVGVvODV2QT09  
password is 076877 if needed.
RTG Seminar on Number Theory  
Monday, February 08, 2021, 4:00pm-4:50pm  
Virtual  
Liyang Yang (Caltech)  
Central L-values on $U(2,1) \times U(1,1)$, Nonvanishing and Subconvexity

In this talk, we study an average of automorphic periods on $U(2,1) \times U(1,1)$. We also compute local factors in Ichino-Ikeda formulas for these periods to obtain an explicit asymptotic expression. Combining them together we would deduce some important properties of central L-values on $U(2,1) \times U(1,1)$ over certain family: the first moment, nonvanishing and subconvexity. This is joint work with Philippe Michel and Dinakar Ramakrishnan.

Zoom link:  
https://umich.zoom.us/j/95185733075  
Meeting ID: 951 8573 3075  
Passcode: umrtg

Student Analysis  
Monday, February 08, 2021, 5:00pm-6:00pm  
Virtual  
Ilya Marchenko (Notre Dame)  
Regularity of Singular Sets of Solutions to Elliptic Equations

Faculty Spotlight  
Monday, February 08, 2021, 5:30pm-7:00pm  
Bieri and Wu ()  
PDE

Teaching Mathematics  
Tuesday, February 09, 2021, 1:00pm-2:30pm  
Virtual  
LCIT Discussion ()  
Learning Community on Inclusive Teaching Discussion

In this session, we will make a transition from reflecting on our classrooms, department and institutions, to thinking about mathematics itself as a system that promotes white supremacy. The readings provide a starting point for considering this.
Colloquium Series  
Tuesday, February 09, 2021, 4:00pm-5:00pm  
Virtual  
Jordan Ellenberg (University of Wisconsin)  
*Beyond rank*

The notion of the rank of a matrix is one of the most fundamental in linear algebra. The analogues of this notion in multilinear algebra - e.g., what is the "rank" of an $m \times n \times p$ array of numbers? - are much less well-understood, and are often thought of as of niche interest. At least, that's how I was brought up to think of them, until Terry Tao explained to me that the resolution of the cap set conjecture by Croot, Lev, Pach, Gijswijt and myself really made use of these ideas! In fact, these notions are of great current interest in a wide range of mathematical subjects at the moment! Issues about "higher rank" arise in complexity theory, data science, geometric combinatorics, additive number theory, quantum mechanics, and commutative algebra - I will manage to say something about some to-be-specified proper subset of these topics, and am happy to chat afterwards about the others.

https://msu.zoom.us/j/92245294720  
Meeting ID: 922 4529 4720  
Passcode: 713158

Complex Analysis, Dynamics and Geometry  
Tuesday, February 09, 2021, 5:00pm-6:00pm  
Virtual  
InSung Park (Indiana University)  
*Julia sets with Ahlfors-regular conformal dimension one*

Ahlfors-regular conformal dimension, abbreviated by $\text{ARconfdim}$, is the infimum of the Hausdorff dimension in a quasisymmetric class of Ahlfors-regular metric spaces. Being embedded in the sphere, Julia sets of post-critically finite rational maps have $\text{ARconfdim}$ between 1 and 2. A Julia set has $\text{ARconfdim}$ 2 if and only if it is the whole sphere. In this talk, we discuss the other extreme case, when $\text{ARconfdim}=1$, which contains critically fixed rational maps and post-critically finite polynomials or Newton maps. We show that the Julia set of a post-critically finite hyperbolic rational map $f$ has $\text{ARconfdim}$ 1 if and only if there exists an $f$-invariant graph $G$ containing the post-critical set such that the dynamics restricted to $G$ has topological entropy zero. We also discuss Sullivan's dictionary related to this work.
Student Combinatorics
Tuesday, February 09, 2021, 5:00pm-6:00pm
Virtual
Shelby Cox ()
Combinatorial Aspects of June Huh's thesis

We will begin with a brief overview of different axiomatizations of matroids and intersection theory on toric varieties. We will then delve deeper into the combinatorics of matroids and talk about the characteristic polynomial, Rota's conjecture, Weisner's theorem, and the balancing condition. Finally, we will sketch June Huh's proof of Rota's conjecture using the tools listed above. The talk should be accessible to all graduate students.

Zoom link: https://umich.zoom.us/j/95088797965
Password: cookies

Financial/Actuarial Mathematics
Wednesday, February 10, 2021, 4:00pm-5:00pm
Virtual
Qingshuo Song (WPI)
Gradient estimate of HJB and its applications in Graphon Mean Field Game

The Graphon Mean Field Game equations consist of a collection of parameterized Hamilton-Jacobi-Bellman equations, and a collection of parameterized Fokker-Planck-Kolmogorov equations coupled through a given graphon. In this talk, we will discuss the sensitivity of the gradient of HJB solutions with respect to the coefficients, which can be used for the solvability of Graphon Mean Field Game equation. It's based on the joint work with Peter Caines, Daniel Ho, Minyi Huang, and Jiamin Jian, see https://arxiv.org/pdf/2009.12144.pdf.
Algebraic Geometry
Wednesday, February 10, 2021, 4:00pm-5:00pm
Zoom
Christian Sevenheck (TU Chemnitz)
Free divisors, V-filtration and Hodge ideals

In this talk, I will describe some results (joint work with Alberto Castano Dominguez and Luis Narvaez Macarro) on Hodge ideals for a specific class of divisors with non-isolated singularities. Hodge ideals as defined by Mustata and Popa generalize multiplier ideals and are given by the Hodge filtration on the module of meromorphic functions along a divisor. However, they are usually hard to determine. For a certain class of free divisors (e.g. free hyperplane arrangements), one can rely on specific symmetry properties of the Bernstein-Sato polynomial of the divisor, and a basic property of Hodge modules, called strict specializability, to give a purely algebraic description of all Hodge ideals. I will explain this approach, and discuss some significant examples.

RTG Seminar on Geometry, Dynamics and Topology
Wednesday, February 10, 2021, 4:00pm-5:30pm
https://umich.zoom.us/j/92258297975 East Hall
Asaf Katz (U Michigan)
Gaps statistics and ergodic theory

I will explain a beautiful theorem of Curt McMullen and Noam Elkies proving that the gaps statistics of the sequence of fractional parts of sqrt(n) is not exponential, confirming a conjecture of Michael Boshernitzan. The proof makes use of geometry of numbers and transfers the problem into the realm of homogeneous dynamics, where Ratner's measure classification theorem can be utilized.

Here is the zoom info:
https://umich.zoom.us/j/92258297975

Topology
Thursday, February 11, 2021, 3:00pm-4:00pm
Virtual
Zachary Himes (Purdue University)
Secondary homological stability and periodic homological stability for unordered configuration spaces

Secondary homological stability is a recently discovered stability pattern for the homology of a sequence of spaces exhibiting homological stability in a range where homological stability does not hold. We prove secondary stability for unordered configuration spaces of manifolds. The main difficulty is the compact case (the non-compact case was previously known by some experts). In the compact case, there are no obvious stabilization maps and the homology does not stabilize but is periodic. We resolve this issue by constructing a chain-level stabilization map for configuration spaces of compact manifolds.
Arithmetic Geometry Learning  
Thursday, February 11, 2021, 4:00pm-5:30pm  
East Hall  
Shizhang Li ()  
t-structures and recollement

Student Commutative Algebra  
Friday, February 12, 2021, 2:00pm-3:00pm  
Virtual  
Sridhar Venkatesh ()  
F-singularities

This will be an introduction to a few of the many F-words that you might have heard of (F-finite, F-regular, Frobenius split). The talk will be basic and should definitely be accessible to anyone who has taken Math 614 (Commutative Algebra). I also promise to provide as many examples as possible! zoom link: https://umich.zoom.us/j/94949291807
Constraints are ubiquitous when studying mechanical systems: the simple pendulum requires that the bob maintains a constant distance from the pivot, an ice skate requires that the skate cannot slide perpendicular to its heading, and a billiard ball is required to remain within the confines of the billiard table. The constraint for the pendulum is called holonomic as it can be expressed as a function on the positions, while the ice skate is nonholonomic as it can only be expressed with velocities. Unlike the previous cases where the constraints are continual, the constraint for the billiard ball is an impact-type that only appears when the ball strikes the edge of the table.

In this talk we will derive the equations of motion for both nonholonomic and impact systems, as well as study a few of their properties. All of these systems will remain energy-preserving but the question of volume-preservation becomes much more difficult: It turns out that the existence of an invariant volume for impact systems severely inhibits Zeno behavior (systems experiencing infinite impacts in a finite amount of time). We will demonstrate necessary and sufficient conditions for when such an invariant volume exists and see that this invariant volume does not depend on the location of the impacts, e.g. the billiard ball is volume-preserving for any compact table-top.

Laurent phenomenon algebras (LP algebras) were introduced by Lam as and Pylyavskyy as a generalization of cluster algebras. Graph LP algebras are LP algebras that have an initial seed and exchange relations encoded by a graph. In this talk, we describe a combinatorial procedure for obtaining certain cluster variables as Laurent polynomials in cluster variables from a given seed. This procedure generalizes Schiffler's T-path formula for type A cluster algebras.
Student Algebraic Geometry
Friday, February 12, 2021, 3:00pm-4:00pm
Virtual
Michael Mueller (UM)
Moduli of stable curves and curve counting

The set of k-planes in a vector space V (the Grassmannian Gr(k, V)) has a natural geometric structure, giving an example of a moduli space. Similarly (modulo technical caveats) we can talk about a moduli space of algebraic curves of genus g, which has a useful compactification consisting of "stable" curves. In this talk I will give a gentle introduction to the moduli space of stable curves and provide some motivation for working with it, such as applications to counting curves on varieties.

Preprint Algebraic Geometry
Friday, February 12, 2021, 4:00pm-5:30pm
East Hall
James Hotchkiss ()

de Jong: The period-index problem for the Brauer group of an algebraic surface (part II)