### Weekly Seminar & Events Bulletin
October 24th, 2021 - October 30th, 2021

#### Monday, October 25, 2021

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
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<td><strong>RTG Seminar on Number Theory</strong> -- Patrick Daniels (University of Michigan) Prismatic higher displays and F-gauges</td>
<td>4088 East Hall</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Complex Analysis, Dynamics and Geometry</strong> -- Malavika Mukundan (U(M)) Dynamic Embeddings</td>
<td>3096 East Hall</td>
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<td>4:00pm-5:00pm</td>
<td><strong>Integrable Systems and Random Matrix Theory</strong> -- Brian Simanek (Baylor University) Universality Limits for Orthogonal Polynomials</td>
<td>ZOOM ID: 926 6491 9790 Virtual</td>
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<td><strong>Colloquium Series</strong> -- Akshay Venkatesh (Institute for Advanced Study) Rainich Lecture #1: 3987^{12} + 4365^{12} = 4472^{12} (almost)</td>
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<td><strong>Learning Seminar in Algebraic Combinatorics</strong> -- Amanda Schwartz (UM) R-polynomials</td>
<td>4088 EH</td>
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<td><strong>Special Events</strong> -- Akshay Venkatesh (Institute for Advanced Study) Rainich Lecture #2: Symplectic L-Functions and Their Topological Analogues</td>
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<td><strong>Special Events</strong> -- Akshay Venkatesh (Institute for Advanced Study) Rainich Lecture #3: Relative Langlands Duality</td>
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<td><strong>Logic</strong> -- Andreas Blass (UM) Tukey Ordering and Forcing Preservation of Ultrafilters</td>
<td>2866 East Hall</td>
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<td><strong>Student Dynamics/Geometry Topology</strong> -- Schinella D'Souza (University of Michigan) Polynomial Matings</td>
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<td><strong>Representation Stability</strong> -- Arthur Bik (Max Planck) (NONSTANDARD TIME) Strength of polynomials</td>
<td>Online</td>
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<td><strong>Applied Interdisciplinary Mathematics (AIM)</strong> -- TBA () TBA -- ZOOM East Hall</td>
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<td><strong>Combinatorics</strong> -- Will Dana (University of Michigan) Stability of stretched root systems, root posets, and shards</td>
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<td>3:00pm-3:50pm</td>
<td><strong>Learning Seminar in Representation Stability</strong> -- Bobby Laudone (UM) TBA -- 1866 East Hall</td>
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<td><strong>Geometry</strong> -- Ilesnami Adeboye (Wesleyan University) A volume bound for orbifold quotients of symmetric spaces</td>
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<td>4:00pm-5:00pm</td>
<td><strong>MCAIM Graduate Seminar</strong> -- Preetham Mohan (University of Michigan) A Brief History of Quantum Learning Theory</td>
<td>2866 East Hall</td>
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| 4:00pm-5:30pm | **Preprint Algebraic Geometry** -- Jonghyun Lee () Compact Kähler manifolds with no projective | http://www.math.lsa.umich.edu/seminars_events/ - Page 1/9
specialization -- 4096 East Hall
RTG Seminar on Number Theory  
Monday, October 25, 2021, 3:00pm-4:00pm  
4088 East Hall  
Patrick Daniels (University of Michigan)  
Prismatic higher displays and F-gauges

We will examine two potential categories of coefficients for prismatic cohomology: the prismatic F-gauges of Drinfeld, and prismatic higher displays. We will explain why the two categories agree over perfect fields of characteristic $p$ and discuss their relationship in general.

Complex Analysis, Dynamics and Geometry  
Monday, October 25, 2021, 4:00pm-5:00pm  
3096 East Hall  
Malavika Mukundan (U(M))  
Dynamical Embeddings

In this talk, we explore the structural similarities in the connectedness loci of unicritical polynomials of various degrees, and introduce a way to study these similarities. The main result presented in the talk is that postcritically finite unicritical parameters of any degree $d$ can be embedded into the space of PCF unicritical parameters of degree $d+1$, in a way that is 'consistent' at the level of the Hubbard tree, and the underlying spider. We also discuss consequences to core entropy of PCF unicritical polynomials. We end by considering possible extensions of these embeddings, and further directions to explore.

Integrable Systems and Random Matrix Theory  
Monday, October 25, 2021, 4:00pm-5:00pm  
ZOOM ID: 926 6491 9790 Virtual  
Brian Simanek (Baylor University)  
Universality Limits for Orthogonal Polynomials

We will consider the scaling limits of polynomial reproducing kernels for measures on the real line. For many years there has been considerable research to find the weakest assumptions that one can place on a measure that allows one to prove that these rescaled kernels converge to the sinc kernel. Our main result will provide the weakest conditions that have yet been found. In particular, it will demonstrate that one only needs local conditions on the measure. We will also settle a conjecture of Avila, Last, and Simon by showing that convergence holds at almost every point in the essential support of the absolutely continuous part of the measure.

<b>A recording of the talk can be found <a href='https://youtu.be/9_NhfLEBQGo'>here</a>.</b>
RTG Representation Theory  
Monday, October 25, 2021, 4:00pm-5:15pm  
4088 East Hall  
Ilia Nekrasov (UM)  
*Quantum sl2 and knots*

Student Analysis  
Monday, October 25, 2021, 5:00pm-6:00pm  
3866 East Hall  
Som Phene (University of Michigan)  
*Modular Mirror symmetry for no invariant Measures on a Lie group*

Recent applications of Mirror Symmetry to Black Holes, Quantum Control and Field Theory involve construction of action invariant Measures on Lie Groups. We will go through the construction and existence for bi-invariant measure via modularity in the symmetry under the Lie Group action.

Student Commutative Algebra  
Tuesday, October 26, 2021, 3:00pm-4:00pm  
2866 East Hall  
Shelby Cox (University of Michigan, Ann Arbor)  
*Introduction to Valuations*

A valuation is a function that assigns multiplicities or "sizes" to ring elements. I will begin by defining valuations and exploring algebraic properties of valuation rings. I will also try to give some historical context for valuations and emphasize connections to number theory and algebraic geometry. We will discuss the local-to-global principle, the valuative criterion, and semi-stable models, as time permits.

Colloquium Series  
Tuesday, October 26, 2021, 4:00pm-5:00pm  
1360 East Hall  
Akshay Venkatesh (Institute for Advanced Study)  
*Rainich Lecture #1: 3987^{12} + 4365^{12} = 4472^{12} (almost)*

Not quite! How do we produce such fake solutions? I will review work of several authors (Coppersmith, Elkies, Bombieri-Pila, Heath-Brown) about this, and the related question of bounding the number of integral solutions to a polynomial equation $P(x_1, ..., x_n) = 0$. I will then explain a recent result with Lawrence and Ellenberg (https://arxiv.org/abs/2109.01043) showing that integral points are "rare" on many natural moduli spaces.
Learning Seminar in Algebraic Combinatorics  
**Wednesday, October 27, 2021, 2:30pm-4:00pm**  
4088 EH  
Amanda Schwartz (UM)  
*R-polynomials*

We will define and compute examples of R-polynomials, which were first introduced by Kazhdan and Lusztig. These polynomials give the point count of Richardson varieties over a finite field. We will also discuss connections between R-polynomials and HOMFLYPT polynomials.

**Special Events**  
**Wednesday, October 27, 2021, 4:00pm-5:00pm**  
1324 East Hall  
Akshay Venkatesh (Institute for Advanced Study)  
*Rainich Lecture #2: Symplectic L-Functions and Their Topological Analogues*

The topology of the symplectic group enters into many different areas of mathematics. After discussing a couple of "classical" manifestations of this, I will explain a new one, in the theory of L-functions, as well as a purely topological analogue of the statement. I am not going to assume any familiarity with the theory of L-functions for the talk. Joint work with Amina Abdurrahman.

**Topology**  
**Thursday, October 28, 2021, 3:00pm-4:00pm**  
3866 East Hall  
Matthew Stoffregen (Michigan State University)  
*Homology Cobordism and Involutive Floer homology*

We'll give a gentle sketch of involutive Heegaard Floer homology, and describe some of its applications to the homology cobordism group of integer homology three-spheres. This talk comes from joint work with Irving Dai, Kristen Hendricks, Jen Hom, Linh Truong, and Ian Zemke.
If we are given a compact Lie group $G$ acting on a space $X$, a powerful tool in "approximately" decomposing the $G$-action on functions on $X$ is the orbit method. I will describe this method and how it sometimes refines to an exact algebraic statement which involves a "dual" group $G^\wedge$ and dual space $X^\wedge$. This is part of a joint work with David Ben-Zvi and Yiannis Sakellaridis about duality in the relative Langlands program, and I will explain that viewpoint at the end and how it connects to lecture 2. I will do my best to make a large part of the talk comprehensible without familiarity with the framework of the Langlands program.

Logic
Thursday, October 28, 2021, 4:00pm-5:30pm
2866 East Hall
Andreas Blass (UM)
Tukey Ordering and Forcing Preservation of Ultrafilters

I plan to describe two species of ultrafilters on the set of natural numbers and to speculate about a connection between them. For both species, the central question is whether ZFC can prove the existence of such ultrafilters.

One species is defined in terms of the Tukey ordering of directed sets, but it also admits a more combinatorial definition. The other species is defined in terms of preservation by forcing, but it also admits a combinatorial definition. The two combinatorial definitions, though different, have very similar "flavor", and that leads to my speculations.

I'll present the original definitions as well as the combinatorial equivalents, and then I'll discuss attempts to combine the key properties of the two species.

Student Dynamics/Geometry Topology
Thursday, October 28, 2021, 5:30pm-6:30pm
3866 East Hall
Schinella D'Souza (University of Michigan)
Polynomial Matings

In this talk, we will discuss a way to glue together the filled Julia sets for two complex polynomial maps, mainly focusing on the quadratic case. We will talk about the construction of topological and geometric matings of two quadratic polynomials and when these constructions yield quadratic rational maps on the Riemann sphere.
Representation Stability  
Friday, October 29, 2021, 12:00pm-1:00pm  
Online  
Arthur Bik (Max Planck)  
(NONSTANDARD TIME) Strength of polynomials

This talk is about the strength of homogeneous polynomials. The strength is a subadditive invariant determined by the convention that a nonzero polynomial has strength 1 exactly when it is reducible. This invariant has been defined by Ananyan and Hochster in their paper proving Stillman's conjecture and has appeared in various works since.

- Why look at the strength of polynomials?  
- How do you compute it?  
- Is bounded strength a closed condition?  
- What is the strength of a generic polynomial?

I will answer some of these questions.

Applied Interdisciplinary Mathematics (AIM)  
Friday, October 29, 2021, 3:00pm-4:00pm  
ZOOM East Hall  
TBA ()  
TBA
Combinatorics  
Friday, October 29, 2021, 3:00pm-4:00pm  
4088 East Hall  
Will Dana (University of Michigan)  
*Stability of stretched root systems, root posets, and shards*

Most of the finite and affine Coxeter groups fall into well-behaved infinite families. On the level of Coxeter-Dynkin diagrams, each family is constructed by taking a small graph and inserting a path of variable length into it. If we take an arbitrary Coxeter diagram and stretch it out by inserting a path, does the resulting family of Coxeter groups and related objects behave analogously to the finite and affine families? Do attributes of this family admit a uniform description once we stretch far enough?

In this talk, we'll look at two constructions attached to root systems for a Coxeter group -- the root poset, and Reading's theory of shards -- and see how they grow and stabilize when we stretch. As time permits, we'll talk about connections to the study of preprojective algebras. Based on arXiv:2010.10582.

Student Algebraic Geometry  
Friday, October 29, 2021, 3:00pm-4:00pm  
2866 East Hall  
Sanal Shivaprasad (UM)  
*Moduli of Curves*

We will talk about the moduli space of curves. We will also discuss stable curves and the Deligne-Mumford compactification.

Learning Seminar in Representation Stability  
Friday, October 29, 2021, 3:00pm-3:50pm  
1866 East Hall  
Bobby Laudone (UM)  
*TBA*

Geometry  
Friday, October 29, 2021, 4:00pm-5:00pm  
3866 East Hall  
Ilesnami Adeboye (Wesleyan University)  
*A volume bound for orbifold quotients of symmetric spaces*

In this talk, H. C. Wang’s quantitative study of Zassenhaus neighborhoods will be extended to the exceptional Lie groups. The first application is an improved upper bound for the sectional curvature of a semi-simple Lie group. The second application is a uniform lower volume bound for orbifold quotients of symmetric spaces of non-compact type. This is joint work with M. Wang and G. Wei.
With the success of machine learning algorithms and the early promise of quantum computing, it is natural to ask whether efficient quantum learning is possible. Are there learning contexts where we observe a quantum (exponential) speed-up? Are there instances where it is not possible for quantum computers to (significantly) outperform classical ones? In this talk, we begin a discussion on these questions by reviewing the results for several learning problems. In particular, we begin with quantum exact, PAC, and agnostic learning of classical Boolean functions. Thereafter, we will consider statistical and adversarial learning of quantum states. We end with a brief overview of broader quantum machine learning results, including the quest for a quantum neural network.

Preprint Algebraic Geometry
Friday, October 29, 2021, 4:00pm-5:30pm
4096 East Hall
Jonghyun Lee ()

Compact Kähler manifolds with no projective specialization

https://arxiv.org/abs/2101.01075 by Voisin