<table>
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<tr>
<th>Day</th>
<th>Time</th>
<th>Event</th>
<th>Speaker</th>
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<td>Zoom Virtual</td>
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<td>Mia Smith (UM) The Zarankiewicz Problem</td>
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<td>Sarah Peluse (Princeton/IAS) Polynomial and multidimensional configurations in dense sets</td>
<td>1324 East Hall</td>
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<td>4:00pm-5:30pm</td>
<td>Logic</td>
<td>Nate Harman (UM) Ultraproducts and Deligne’s Interpolation Categories</td>
<td>2866 East Hall</td>
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<td>5:30pm-6:30pm</td>
<td>Student Dynamics/Geometry Topology</td>
<td>Ekaterina Shchetka (University of Michigan) What Are Lyapunov Exponents, and Why Do They Matter?</td>
<td>3866 East Hall</td>
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<td>1:00pm-2:00pm</td>
<td>Representation Stability</td>
<td>Inna Entova-Aizenbud (Ben Gurion University) TBA</td>
<td>Online</td>
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<td>Bobby Laudone (UM) Grobner methods in rep stability</td>
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RTG Seminar on Number Theory
Monday, December 06, 2021, 3:00pm-3:50pm
4088 East Hall
Yuan Liu (University of Michigan)
Non-abelian Cohen--Lenstra heuristics in presence of roots of unity

We will first take a brief tour of the Cohen--Lenstra heuristics and its generalizations. In particular, I'll talk about: how these heuristics are related to random matrices, how to use Hurwitz schemes to prove the function field case (Ellenberg--Venkatesh--Westerland), how to modify the heuristics when the base field contains roots of unity (Lipnowski--Tsimerman and Lipnowski--Tsimerman--Sawin), and how to construct the non-abelian generalization of the heuristics (Liu--Wood--Zureick-Brown). In the end, I'll discuss the modification of the non-abelian Cohen--Lenstra heuristics when the base field contains roots of unity, and the construction of a non-abelian random group model for this case.

RTG Representation Theory
Monday, December 06, 2021, 4:00pm-5:15pm
4088 East Hall
Carsten Peterson (UM)
Dynamics related to SL2(R)

Integrable Systems and Random Matrix Theory
Monday, December 06, 2021, 4:00pm-5:00pm
ZOOM ID: 926 6491 9790 Virtual
ISRMT Holiday Edition!

The semester is coming to a close here in Michigan!

To celebrate another successful semester in the books, bring your favorite hot beverage and join us in a relaxed discussion. Come decompress, discuss mathematical highlights from this semester, get ideas for wrapping up the classes you are attending and/or teaching, or just socialize!
Complex Analysis, Dynamics and Geometry  
**Monday, December 06, 2021, 4:00pm-5:00pm**  
**Zoom Virtual**  
**Khashayar Filom (U(M))**  
_On the rank of the Thurston pullback map_

Under some mild assumptions, an orientation-preserving branched covering map of marked 2-spheres induces a pullback map between the corresponding Teichmüller spaces. By analyzing the associated pushforward operator acting on integrable quadratic differentials, we obtain a global lower bound on the rank of the derivative of the pullback map in terms of the action of the cover on marked points. In the dynamical context, the two sets of marked points in the target and source coincide with the postcritical set. Investigating the resulting pullback map is the central part of Thurston's topological characterization of postcritically finite rational maps. Postcritically finite maps with constant pullback have been studied by various authors. In that direction, our approach provides upper bounds on the size of the postcritical set of a map with constant pullback, and shows that the postcritical dynamics is highly restricted.  
This talk will be given over Zoom. Please email Sarah (kochsc@umich.edu) for the Zoom info.

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**Student Combinatorics**  
**Monday, December 06, 2021, 4:00pm-5:00pm**  
**3866 East Hall**  
**Mia Smith (UM)**  
_The Zarankiewicz Problem_

One of the foundational results in extremal graph theory is the Erdős-Stone Theorem, which says that \( \text{ex}(n, H) = \frac{(X(H)-2)(X(H)-1)+o(1)}{X(H)-1} n^2/2 \) where \( \text{ex}(n,H)+1 \) is the minimum number of edges needed to guarantee that any \( n \)-vertex graph contains \( H \) as a subgraph. However, this theorem gives little information for \( X(H)=2 \). In this lecture we'll examine the Zarankiewicz problem, which considers the case when \( H \) is a complete bipartite graph.

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**Student Commutative Algebra**  
**Tuesday, December 07, 2021, 3:00pm-4:00pm**  
**2866 East Hall**  
**Jonghyun Lee (University of Michigan, Ann Arbor)**  
_The Auslander-Buchsbaum formula via derived categories_

The Auslander-Buchsbaum formula relates the depth and projective dimension of a module over a noetherian local ring. In this talk, we will introduce the spirit of derived categories through a nice proof of the Auslander-Buchsbaum formula.
Colloquium Series
Tuesday, December 07, 2021, 4:00pm-5:00pm
virtual
Will Sawin (Columbia University)
Finite quotients of 3-manifold groups

Let G and H be two finite groups. Does there exist a 3-manifold whose fundamental group admits G as a quotient but not H? We prove a theorem that determines the answers to questions of this type. The proof, when we need to show that a 3-manifold with certain properties exists, relies on a probabilistic argument - we estimate the probability that a random 3-manifold (according to a distribution defined by Dunfield and Thurston) has those properties. Our methods thus mix topology, group theory, and probability, and they were inspired by work in number theory. This talk will discuss the connections to those fields. This is joint work with Melanie Wood.

https://umich.zoom.us/j/97472072420?pwd=T0w3MHpEd2NRMiQ4WjFpdUdnN3BGUT09
Meeting ID: 974 7207 2420
Passcode: UMColloq

Special Events
Tuesday, December 07, 2021, 5:30pm-7:00pm
Lower Math Atrium East Hall
LoG(M) Poster Session

The students in the Laboratory of Geometry at Michigan will be presenting poster on the culmination of their semester of work. For more information on the projects, please see the LoG(M) website, https://lsa.umich.edu/math/undergraduates/research-and-career-opportunities/LoGM.html.

Learning Seminar in Algebraic Combinatorics
Wednesday, December 08, 2021, 2:30pm-4:00pm
4088 East Hall
George Seelinger (UM)
The complexes for computing some torus knot homology

In Mellit's computation of the knot homology of the (m,n)-torus knot for coprime m and n, we saw the sweeping method relied on a few relations among the homology of certain complexes of Soergel bimodules. In this talk, we will attempt to explore the homological underpinnings of these relations in order to better understand the underlying complexes. Time permitting, we may also see how to use these complexes to compute the knot homology of the (n,n)-torus knot.
Algebraic Geometry
Wednesday, December 08, 2021, 4:00pm-5:30pm
4096 East Hall
Enrica Mazzon (University of Michigan)
Higher Fano manifolds

Fano manifolds are complex projective manifolds having positive first Chern class. The positivity condition on the first Chern class has far-reaching geometric and arithmetic implications. For instance, Fano manifolds are covered by rational curves, and families of Fano manifolds over one-dimensional bases always admit holomorphic sections. In recent years, there has been a great effort towards defining suitable higher analogues of the Fano condition. Higher Fano manifolds are expected to enjoy stronger versions of several of the nice properties of Fano manifolds. For instance, they should be covered by higher dimensional rational varieties, and families of higher Fano manifolds over higher-dimensional bases should admit meromorphic sections (modulo Brauer obstruction). In this talk, I will discuss a possible notion of higher Fano manifolds in terms of positivity of higher Chern characters, and discuss special geometric features of these manifolds.

Special Events
Wednesday, December 08, 2021, 4:00pm-5:00pm
B844 East Hall
James Stokes (Flatiron Institute, Simons Foundation)
Joint MCAIM / MICDE Talk: Geometry and Numerics of Variational Quantum Algorithms and Classical Counterparts

Abstract: Stokes will review a family of variational algorithms which have been proposed as candidates to make use of near- to intermediate-term quantum computers, placing particular emphasis on geometric and numeric features that are shared by classical variational stochastic approximation algorithms. Stokes will also discuss some applications of this hybrid quantum-classical approach to scientific and engineering problems beyond its traditional domain of application.

Arithmetic Geometry Learning
Thursday, December 09, 2021, 4:00pm-5:30pm
4096 East Hall
Mircea Mustata (University of Michigan)
The $P=W$ conjecture for rank 2 bundles, after de Cataldo, Hausel, and Migliorini, part II
Several of the most important problems in combinatorial number theory ask for the size of the largest subset of an abelian group or interval of integers lacking points in some 'arithmetic' configuration. One example of such a question is, "What is the largest subset of \{1,...,N\} with no nontrivial k-term arithmetic progressions \(x,x+y,...,x+(k-1)y\)?". Gowers initiated the study of higher order Fourier analysis while seeking to answer this question and used it to give the first reasonable quantitative bounds. In this talk, I'll discuss what higher order Fourier analysis is and why it is relevant to the study of arithmetic progressions and other configurations, including 'polynomial' and 'multidimensional' configurations, and survey recent progress on problems related to the polynomial and multidimensional generalizations of Szemerédi's theorem.

Deligne defined certain categories which "interpolate" the representation theory of various families of groups. I will explain a bit what these categories are and why they are interesting. Then I will tell the story of me first removing the use of an ultraproduct from his construction, but then putting it back in somewhere else.

We'll discuss Lyapunov exponents and its relation to ergodicity, cocycles, hyperbolicity, and spectrum of almost periodic Schrödinger operators.
**Student Algebraic Geometry**  
**Friday, December 10, 2021, 3:00pm-4:00pm**  
2866 East Hall  
**Saket Shah (UM)**  
*Cox rings and applications to Mukai's counterexample of Hilbert's 14th problem*

I will briefly describe the Cox ring of a projective variety, which is an important feature of its birational geometry. Afterwards, I sketch the a counterexample for Hilbert's 14th problem constructed by Shigeru Mukai in 2003 as an application of Cox rings, by showing that under some conditions the Cox ring of a blowup of projective space at some number of points will not have a finitely generated Cox ring.

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**Learning Seminar in Representation Stability**  
**Friday, December 10, 2021, 3:00pm-3:50pm**  
1866 East Hall  
**Bobby Laudone (UM)**  
*Grobner methods in rep stability*

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**Combinatorics**  
**Friday, December 10, 2021, 3:00pm-4:00pm**  
4088 East Hall  
**Sarah Peluse (Princeton University)**  
*Entries in the character table of the symmetric group divisible by primes*

In 2017, Miller conjectured, based on computational evidence, that for any fixed prime $p$ the density of entries in the character table of $S_n$ that are divisible by $p$ goes to 1 as $n$ goes to infinity. I'll describe a proof of this conjecture, which is joint work with K. Soundararajan. I will also discuss the (still open) problem of determining the asymptotic density of zeros in the character table of $S_n$, where it is not even clear from computational data what one should expect.

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**Preprint Algebraic Geometry**  
**Friday, December 10, 2021, 4:00pm-5:30pm**  
4096 East Hall  
**Mirko Mauri ()**  
*Seshadri's criterion and openness of projectivity*

https://arxiv.org/abs/2105.06242 by Kollár