	Monday, February 18, 2019
10:00am-11:00am	**Student Homotopy Theory** -- Michael Mueller (University of Michigan) *Introduction to model categories* -- 3088 East Hall
3:00pm-4:00pm	**Student Dynamics** -- Mitul Islam (UM) *Learning Seminar on Benoist's work - Day 2 (Geodesic Flow is Anosov)* -- 3866 East Hall
4:00pm-5:00pm	**Complex Analysis, Dynamics and Geometry** -- Ilya Gekhtman (University of Toronto) *Geometric and probabilistic boundaries of random walks, metrics on groups and measures on boundaries in negative curvature* -- 3096 East Hall
4:00pm-6:00pm	**Geometry & Physics** -- Junliang Shen (MIT) *Perverse filtrations, curve counting invariants, and hyper-kÃƒÂ¤hler geometry* -- 4096 East Hall
4:00pm-5:00pm	**Student Combinatorics** -- Karthik Ganapathy (University of Michigan) *The Diamond Lemma* -- 3866 East Hall
4:00pm-5:00pm	**Integrable Systems and Random Matrix Theory** -- Asad Lodhia (University of Michigan) *Harmonic Means of Wishart Random Matrices* -- 1866 East Hall
4:20pm-5:30pm	**Group, Lie and Number Theory** -- Luis Garcia (University of Toronto) *Transgression of the Euler class and arithmetic applications (Note special time)* -- 4088 East Hall
7:00pm-8:00pm	**Geometric Quantization and Symplectic Geometry** -- Alejandro Uribe (University of Michigan) *Polarizations* -- 4088 East Hall

	Tuesday, February 19, 2019
3:00pm-4:00pm	**Student Geometry/Topology** -- Karen Butt (University of Michigan) *Introduction to symplectic topology* -- 1866 East Hall
3:00pm-3:50pm	**Student Commutative Algebra** -- Takumi Murayama (University of Michigan) *Local cohomology and Hartshorne's conjecture* -- 3866 East Hall
4:00pm-5:00pm	**Colloquium Series** -- Sug Woo Shin (University of California, Berkeley) *Cohomology of Shimura varieties* -- 1360 East Hall

	Wednesday, February 20, 2019
2:30pm-4:00pm	**Student Machine Learning** -- Saibal De (University of Michigan) *Optimization for Training Deep Models* -- 3866 East Hall
4:00pm-5:00pm	**Student Arithmetic** -- () *No talk (conflict with mandatory presentation)* -- 3088 East Hall
4:00pm-5:00pm	**Special Events** -- () *Sexual Misconduct and You, a GSI tutorial* -- 1324 East Hall
5:00pm-6:00pm	**Algebraic Geometry** -- Vladimir Berkovich (Weizmann Institute) *Hodge theory for non-Archimedean analytic spaces ***Note unusual time**** -- 4096 East Hall
5:00pm-6:00pm	**Working Group on Anderson Localization** -- Tyler Bolles (University of Michigan) *Ergodic Schrodinger Operators (Continued)* -- 4088 East Hall

	Thursday, February 21, 2019
3:00pm-4:00pm	**Commutative Algebra** -- Jenny Kenkel (University of Utah) *Local cohomology of thickenings* -- 3866 East Hall
3:00pm-4:00pm	**Topology** -- Bena Tshishiku (Harvard) *Surface bundles, monodromy, and arithmetic groups* -- 4096 East Hall
4:00pm-5:00pm	**Student Algebraic Geometry** -- Devlin Mallory (UM) *Introduction to the minimal model program* -- B735 East Hall

Friday, February 22, 2019

3:00pm-4:00pm	**Geometry** -- Andrew Zimmer (LSU) *The geometry of domains with negatively pinched Kahler metrics* -- 3866 East Hall
3:00pm-4:00pm	**Applied Interdisciplinary Mathematics (AIM)** -- Monika Nitsche (University of New Mexico) *Boundary integral formulation for Stokes equation in multi-fluid domains* -- 1084 East Hall
3:00pm-4:00pm	**Combinatorics** -- Dylan Thurston (Indiana U.) *Unlabelled rigidity* -- 4088 East Hall
3:00pm-5:00pm	**Special Events** -- Marc Lange (University of North Carolina at Chapel Hill) *FOMP Lecture: Inference to the Best Explanation as a Form of Non-Deductive Reasoning in Mathematics* -- 1171 (Tanner Library) Angell Hall
4:00pm-4:50pm	**Junior Colloquium Series** -- Alex Wright (University of Michigan) *Random surfaces.* -- 3088 East Hall
4:00pm-5:00pm	**Student AIM Seminar** -- Leighton Wilson (University of Michigan) *Below Absolute Zero: A Casual Introduction to Statistical Mechanics* -- 1084 East Hall

Saturday, February 23, 2019

12:00am-12:00am	**Geometry & Physics** -- FRG Workshop (Feb 23-24, 2019) *The Workshop on strata of abelian differentials and effective r-spin structures* -- 4096 East Hall

Abstracts for the week of February 17th, 2019 - February 23rd, 2019

Student Homotopy Theory
Monday, February 18, 2019, 10:00am-11:00am
3088 East Hall
Michael Mueller (University of Michigan)
Introduction to model categories

Notions from homotopy theory can be used not only in the category of topological spaces, but also in the settings of other categories like simplicial sets or chain complexes of R-modules. The concept of a model category axiomatizes the assumptions needed to study "homotopy theory" in various categories. In this talk I will give a brief introduction to model categories and discuss applications (time permitting).

Student Dynamics
Monday, February 18, 2019, 3:00pm-4:00pm
3866 East Hall
Mitul Islam (UM)
Learning Seminar on Benoist's work - Day 2 (Geodesic Flow is Anosov)

We will continue our discussion of the main theorem in Convex Divisible I (Y. Benoist). The focus will be on the proof that strictly convex divisible Hilbert geometries have Anosov geodesic flow. Using some other facts from dynamics, we will observe that this implies C^1 (in fact, slightly more than C^1) regularity of the boundary. This completes the proof of the main theorem. Time permitting, I will explain how the results discussed so far give us some rigidity results in Hilbert geometry.

Complex Analysis, Dynamics and Geometry
Monday, February 18, 2019, 4:00pm-5:00pm
3096 East Hall
Ilya Gekhtman (University of Toronto)

Geometric and probabilistic boundaries of random walks, metrics on groups and measures on boundaries in negative curvature

Consider a geometrically finite isometry group of a pinched negatively curved contractible manifold. There are two natural averaging procedures on this group: averaging with respect to balls in the manifold and taking a finitely supported random walk.

These correspond to two natural measures on the boundary the Patterson-Sullivan measure (which for symetric manifolds is in the Lebesgue measure class) and the harmonic measure which is the limit of convolution powers of the random walk.

These two measures satisfy conformality properties with respect to two metrics on the lattice: the metric induced by the orbit map d and the so called Green metric d_G associated to the random walk, which is quasi-isometric to the word metric.

In turn, they correspond to two measures on the unit tangent bundle (the measure of maximal entropy and the harmonic invariant measure) and closed geodesics on the quotient manifold satisfy two different equidistribution properties with respect to the two measures.

We will show that the harmonic and Patterson-Sullivan measures are singular unless the two metrics are roughly similar: $|d-c_1 d_G| < c_2$ for uniform constants c_1, c_2. Thus, they are always singular when the isometry group contains parabolics.

Everything can be generalized to geometrically finite actions on proper Gromov hyperbolic spaces, such as Hilbert geometries.

Furthermore, our techniques can be generalized to show that when the fundamental group contains parabolics, harmonic measures for finitely supported random walks are singular to any Gibbs measure associated to a Hoelder potential.

This is based on several joint works with Gerasimov-Potyagailo-Yang, with M. Dussaule, and with G. Tiozzo.

LSA MATHEMATICS
UNIVERSITY OF MICHIGAN
Weekly Seminar & Events Bulletin
February 17th, 2019 - February 23rd, 2019

Geometry & Physics
Monday, February 18, 2019, 4:00pm-6:00pm
4096 East Hall
Junliang Shen (MIT)
Perverse filtrations, curve counting invariants, and hyper-kähler geometry

For a hyper-kähler variety equipped with a Lagrangian fibration, an increasing filtration is defined on its rational cohomology using the perverse t-structure. We will discuss the role played by this filtration in the study of the topology and geometry of hyper-kähler varieties, as well as the connection to curve counting invariants of Calabi-Yau 3-folds. In particular, we will discuss recent progress on the P=W conjecture for Hitchin systems, and its compact analog for Lagrangian fibrations. Based on joint work with Qizheng Yin and Zili Zhang.

Student Combinatorics
Monday, February 18, 2019, 4:00pm-5:00pm
3866 East Hall
Karthik Ganapathy (University of Michigan)
The Diamond Lemma

Finding bases for algebras defined by generators and relations is a difficult task. However, George Bergman introduced a technique based on the classical Diamond Lemma (originally due to Max Newman) to prove nice bases exist for certain algebras. The talk will be a basic introduction to the Diamond Lemma with some applications to combinatorics. Time permitting, I shall also give an overview of Bergman's version of the Diamond Lemma by using the Poincare-Birkhoff-Witt theorem as a guiding example.

Integrable Systems and Random Matrix Theory
Monday, February 18, 2019, 4:00pm-5:00pm
1866 East Hall
Asad Lodhia (University of Michigan)
Harmonic Means of Wishart Random Matrices

Let X_i be an i.i.d sequence of PxN random matrices with independent standard complex gaussian entries. Let $W_i = X_i X_i^T/N$ be a sequence of i.i.d Wishart random matrices associated with these X_i. We show that in operator norm the Harmonic mean of the W_i is closer to the identity than the arithmetic mean of the W_i when we take a small number of matrices. We will prove this by using free probability to explicitly compute the limiting spectral measure of the Harmonic Mean. This phenomenon is expected to be true even in the case where the expectation of the W_i are no longer the identity but are a fairly general class of covariance matrices.

Group, Lie and Number Theory
Monday, February 18, 2019, 4:20pm-5:30pm
4088 East Hall
Luis Garcia (University of Toronto)
Transgression of the Euler class and arithmetic applications (Note special time)

I will survey recent work (joint with N. Bergeron and P. Charollois) giving a new construction of certain cohomology classes of SL_N(Z) that were first defined by Nori and Szcech. To motivate our approach, I will start by discussing the problem of how to compute linking numbers in certain three-manifolds that fiber over the circle, e.g in the complement of the trefoil knot in the 3-sphere. We will see that these linking numbers are special values of L-functions, which implies that the latter are rational numbers. Then I will explain some generalizations that relate the topology of real locally symmetric spaces with the arithmetic world of modular forms.

Geometric Quantization and Symplectic Geometry
Monday, February 18, 2019, 7:00pm-8:00pm
4088 East Hall
Alejandro Uribe (University of Michigan)
Polarizations

As we saw last time, the Lie algebra of smooth functions on a symplectic manifold can be faithfully represented by first-order differential operators acting on sections of a pre-quantum line bundle. However, the Hilbert space of all such sections is known to be "too big". To select an appropriate subspace one needs the notion of polarization of a symplectic manifold. I will discuss this notion, give examples, and describe which Hamiltonians can be represented in the resulting (smaller) Hilbert space.

Student Geometry/Topology
Tuesday, February 19, 2019, 3:00pm-4:00pm
1866 East Hall
Karen Butt (University of Michigan)
Introduction to symplectic topology

In this talk, I will give an overview of some of the basic concepts in symplectic topology. I will start by outlining the Hamiltonian formulation of classical mechanics and showing how symplectic structures naturally arise in this context. I will then discuss and give examples of Hamiltonian flows, symplectomorphisms and moment maps.

Student Commutative Algebra
Tuesday, February 19, 2019, 3:00pm-3:50pm
3866 East Hall
Takumi Murayama (University of Michigan)
Local cohomology and Hartshorne's conjecture

Let C be a curve in the 3-dimensional projective space P^3. Hartshorne's conjecture says that as long as it is irreducible, the curve C can be defined using only two equations. While easy to state, this conjecture has not been resolved. We study this conjecture using local cohomology, which is was originally constructed in the 1960s as a tool to study sheaves and their cohomology in algebraic geometry. Since then, it has become a powerful tool in commutative algebra, especially because local cohomology is very computable. In this talk, we will focus on examples and computations concerning Hartshorne's conjecture, and will only assume knowledge from MATH 593 for the majority of the talk.

Colloquium Series
Tuesday, February 19, 2019, 4:00pm-5:00pm
1360 East Hall
Sug Woo Shin (University of California, Berkeley)
Cohomology of Shimura varieties

Shimura varieties are a certain class of algebraic varieties over number fields with lots of symmetries, introduced by Shimura Deligne nearly half a century ago. They have been playing a central role in number theory and other areas. Langlands proposed a program to compute the L-functions and cohomology of Shimura varieites in 1970s; this was refined by Langlands-Rapoport and Kottwitz in 1980s. I will review some old and recent results in this direction.

Weekly Seminar & Events Bulletin
February 17th, 2019 - February 23rd, 2019

Student Machine Learning
Wednesday, February 20, 2019, 2:30pm-4:00pm
3866 East Hall
Saibal De (University of Michigan)
Optimization for Training Deep Models

Deep learning algorithms involve optimization in many contexts. For example, performing inference in models such as PCA involves solving an optimization problem. We often use analytical optimization to write proofs or design algorithms. Of all the many optimization problems involved in deep learning, the most difficult is neural network training. It is quite common to invest days to months of time on hundreds of machines to solve even a single instance of the neural network training problem. Because this problem is so important and so expensive, a specialized set of optimization techniques have been developed for solving it.

We begin with a description of how optimization used as a training algorithm for a machine learning task differs from pure optimization. Next, we present several of the concrete challenges that make optimization of neural networks difficult. We then define several practical algorithms, including both optimization algorithms themselves and strategies for initializing the parameters. More advanced algorithms adapt their learning rates during training or leverage information contained in the second derivatives of the cost function. Finally, we conclude with a review of several optimization strategies that are formed by combining simple optimization algorithms into higher-level procedures

Student Arithmetic
Wednesday, February 20, 2019, 4:00pm-5:00pm
3088 East Hall
()
No talk (conflict with mandatory presentation)

Special Events
Wednesday, February 20, 2019, 4:00pm-5:00pm
1324 East Hall
()
Sexual Misconduct and You, a GSI tutorial

Dear Graduate Students,

You have certainly noticed that earth-shaking (or at least career breaking) changes in society are afoot regarding expectations around gender, power and sexual misconduct. These changes effect all of us, including---or perhaps especially--- those who think "Me too" is not about them!

Math will host an important presentation 4-5 pm on February 20 in 1324 East Hall entitled "Sexual Misconduct and You, a GSI tutorial". Even what is meant by the term "Sexual Misconduct" is quite different from a few years ago. You need to be informed.

We expect every Graduate Student to attend this meeting. We understand that some of you may be teaching at that time, or have another conflict that cannot be rescheduled. Please inform the graduate office (math-grad-office@umich.edu) if you will not be able to attend.

Tony Bloch and Karen Smith

Algebraic Geometry
Wednesday, February 20, 2019, 5:00pm-6:00pm
4096 East Hall
Vladimir Berkovich (Weizmann Institute)
Hodge theory for non-Archimedean analytic spaces ***Note unusual time***

In a work in progress, I've extended the classical construction of the integral vanishing cycles complexes for schemes of finite type over the ring of convergent power series with complex coefficients to so called special formal schemes over the completion of that ring. This allows one to define integral "etale" cohomology groups for a class of non-Archimedean analytic spaces over the fraction field of the above completion. They are finitely generated abelian groups which give rise to all l-adic etale and de Rham cohomology groups of the space. In this talk I'll explain a theorem which states that in the case, when a non-Archimedean space is proper and smooth, its integral "etale" cohomology groups are provided with a mixed Hodge structure functorial in the space. Furthermore, if the space is the non-Archimedean analytification of the generic fiber of a proper scheme over the ring of convergent power series, it is the limit mixed Hodge structure on the integral cohomology groups of the fibers of the complex analytification of the scheme over points of a punctured disc.

Working Group on Anderson Localization
Wednesday, February 20, 2019, 5:00pm-6:00pm
4088 East Hall
Tyler Bolles (University of Michigan)
Ergodic Schrodinger Operators (Continued)

pages 23-27 of Kirsch's notes.

Commutative Algebra
Thursday, February 21, 2019, 3:00pm-4:00pm
3866 East Hall
Jenny Kenkel (University of Utah)
Local cohomology of thickenings

Let R be a standard graded polynomial ring that is finitely generated over a field, and let I be a homogenous prime ideal. Bhatt, Blickle, Lyubeznik, Singh, and Zhang examined the local cohomology of R/I^t, as t goes to infinity, which led to the development of an asymptotic invariant by Dao and MontaÃƒÂ±o. I will discuss their results, and give concrete examples of the calculation of this new invariant in the case of determinantal rings.

Topology
Thursday, February 21, 2019, 3:00pm-4:00pm
4096 East Hall
Bena Tshishiku (Harvard)
Surface bundles, monodromy, and arithmetic groups

Fiber bundles with fiber a surface arise in many areas including hyperbolic geometry, symplectic geometry, and algebraic geometry. Up to isomorphism, a surface bundle is completely determined by its monodromy representation, which is a homomorphism to a mapping class group. This allows one to use algebra to study the topology of surface bundles. Unfortunately, the monodromy representation is typically difficult to Ã¢â¬Å"computeÃ¢â¬Â (e.g. determine its image). In this talk, I will discuss some recent work toward computing monodromy groups for holomorphic surface bundles, including certain examples of Atiyah and Kodaira. This can be applied to the problem of counting the number of ways that certain 4-manifolds fiber over a surface. This is joint work with Nick Salter.

Student Algebraic Geometry
Thursday, February 21, 2019, 4:00pm-5:00pm
B735 East Hall
Devlin Mallory (UM)
Introduction to the minimal model program

The minimal model program is one of the major developments of algebraic geometry in recent decades, although its roots go back to the classical study of the birational geometry of surfaces. In this talk, we'll discuss how the study of surfaces leads naturally to the core objects of study in the MMP, including the cone of curves of a projective variety and its relation to morphisms from a variety. We'll then discuss the generalization to higher dimensions, the resulting difficulties, and the necessary introduction of certain "mild" singularities. Throughout, we'll focus on examples rather than technical details. The talk should be accessible to anyone who's taken 631 or another introductory algebraic geometry course.

Geometry
Friday, February 22, 2019, 3:00pm-4:00pm
3866 East Hall
Andrew Zimmer (LSU)
The geometry of domains with negatively pinched Kahler metrics

Every bounded pseudoconvex domain in C^n has a natural complete Kahler metric: the Kahler-Einstein metric constructed by Cheng-Yau. When the domain is strongly pseudoconvex, they showed that the holomorphic curvature of this metric is asymptotically a negative constant. In this talk I will describe some converses of this result, including the following: if a smoothly bounded convex domain has a complete Kahler metric with sufficiently tight pinched negatively curved holomorphic sectional curvature near the boundary, then the domain is strongly pseudoconvex. The proofs use recent results of Wu-Yau, classical results of Shi on the Ricci flow, and ideas from Benoist's work in real projective geometry. This is joint work with F. Bracci and H. Gaussier.

Applied Interdisciplinary Mathematics (AIM)
Friday, February 22, 2019, 3:00pm-4:00pm
1084 East Hall
Monika Nitsche (University of New Mexico)
Boundary integral formulation for Stokes equation in multi-fluid domains

Our motivation is to study the evolution of double emulsions exiting from a tapered nozzle, driven by a background flow in the nozzle. Laboratory experiments have shown that in certain cases the drops break as they exit, thus releasing the inside phase to the outside (Chen et al., Soft Matter 2011, Vol. 7, no. 6, 2345). Important applications of this process include drug delivery through atomized sprays (e.g., a nose spray), inkjet printing, food processing and cosmetics. Whether or not the drops break was observed to depend on the angle of the nozzle at the exit. Here, we study the dependence of the flow on the various parameters using numerical simulations.

The flow is well described by Stokes equations. We first outline the derivation of the coupled boundary integro-differential formulation of the problem, starting with the basics. We then describe several numerical issues that arise in evaluating the boundary integrals, including regular integrals, singular integrals, and near-singular integrals. We conclude by showing a few numerical results, building from simple geometries, where we can compare against known results for validation, to more complex geometries, leaving us well-positioned for the parameter study.

Combinatorics
Friday, February 22, 2019, 3:00pm-4:00pm
4088 East Hall
Dylan Thurston (Indiana U.)
Unlabelled rigidity

For a graph embedded in Euclidean space, when can you reconstruct the positions of the vertices from the lengths of the edges? The answer depends on the graph. Here we consider the unlabelled version of the problem, where the input is the unordered set of edge lengths, with no correspondence with the edges. We show that for generic configurations, the unlabelled rigidity problem is solvable when the labelled version is.

This is joint work with Steven Gortler and Louis Theran.

Special Events
Friday, February 22, 2019, 3:00pm-5:00pm
1171 (Tanner Library) Angell Hall
Marc Lange (University of North Carolina at Chapel Hill)
FOMP Lecture: Inference to the Best Explanation as a Form of Non-Deductive Reasoning in Mathematics

The confirmation of hypotheses in mathematics by mathematical evidence short of proof has received insufficient attention. I will propose one way to think about some of these cases. I will also suggest one way to model such confirmation using the resources of the probability calculus -- in something like the way that some confirmation of certain scientific hypotheses is modeled (but without denying the status of mathematical truths as necessary).

Sponsored by the Foundations of Modern Physics reading group (a Rackham interdisciplinary working group) and the Philosophy Department.
https://sites.lsa.umich.edu/fomp/

Junior Colloquium Series
Friday, February 22, 2019, 4:00pm-4:50pm
3088 East Hall
Alex Wright (University of Michigan)
Random surfaces.

I'll begin by explaining how to build a hyperbolic surface out of pants, and introducing the moduli space of all hyperbolic surfaces of fixed genus. I'll explain that this moduli space has a natural volume form, and explain Mirzakhani's famous calculation of the total volume in the simplest case. Then I'll turn to the study of random surfaces, and compare this to the study of random d-regular graphs. I'll conclude by telling you about a problem that I'm working on now.

Student AIM Seminar
Friday, February 22, 2019, 4:00pm-5:00pm
1084 East Hall
Leighton Wilson (University of Michigan)
Below Absolute Zero: A Casual Introduction to Statistical Mechanics

This talk will give a brief overview of statistical mechanics, its deep connection to thermodynamics, and its applications. We'll develop just enough machinery to understand the concept of temperature, how certain systems can exhibit temperatures below absolute zero, why below absolute zero is above positive infinite temperatures, and what this physically means.

Geometry & Physics
Saturday, February 23, 2019, 12:00am-12:00am
4096 East Hall
FRG Workshop (Feb 23-24, 2019)
The Workshop on strata of abelian differentials and effective r-spin structures

Conference website

http://www-personal.umich.edu/~janda/2019-holodiff.html