Monday, October 08, 2018
3:00pm-4:00pm  Student Dynamics -- Feng Zhu (University of Michigan) Counting simple geodesics, part II: ergodicity and equidistribution in PML -- 1060 East Hall
4:00pm-5:00pm  Complex Analysis, Dynamics and Geometry -- Thomas Silverman (Brown University) A non-archimedean lambda-lemma -- 3088 East Hall
4:00pm-5:00pm  Geometry & Physics -- Felix Janda (UM) Log GLSM moduli space -- 4096 East Hall
5:15pm-6:30pm  Teaching Mathematics -- Rachel Weir (Allegheny College) Promoting Student Success in Precalculus and Calculus -- 3866 East Hall

Tuesday, October 09, 2018
3:00pm-5:00pm  Special Events -- (University of Michigan) CRLT Players: CUTS - Responding to Student Climate Concerns -- 4448 East Hall East Hall

Wednesday, October 10, 2018
3:00pm-3:50pm  Student Arithmetic -- Harry Richman (University of Michigan) Introduction to p-adic geometry -- 3866 East Hall
4:00pm-5:00pm  Financial/Actuarial Mathematics -- Ibrahim Ekren (Florida State University) Equilibrium option price with competing market makers -- 1360 East Hall
4:00pm-5:20pm  Algebraic Geometry -- Bill Fulton (U Michigan) Determinants and Pfaffians -- 4096 East Hall

Thursday, October 11, 2018
1:00pm-2:30pm  Student Homotopy Theory -- Attilio Castano (University of Michigan) Categorifying Algebra -- 2866 East Hall
3:00pm-4:00pm  Topology -- Jenny Wilson (U(M)) Quillen’s approach to homological stability -- 3088 East Hall
3:00pm-4:00pm  Commutative Algebra -- Francesca Gandini (University of Michigan) Resolutions of ideals associated to subspace arrangements -- 4088 East Hall
4:00pm-5:00pm  Differential Equations -- Changyou Wang (Purdue U.) Some recent results on mathematical analysis of Ericksen-Leslie System -- 4088 East Hall

Friday, October 12, 2018
3:00pm-4:00pm  Applied Interdisciplinary Mathematics (AIM) -- Saverio Spagnolie (University of Wisconsin) Active matter invasion of a viscous fluid and a no-flow theorem -- 1084 East Hall
3:00pm-4:00pm  Geometry -- Mark Greenfield (U Michigan) Metrics and compactifications of Teichmueller spaces of flat tori -- 3866 East Hall
Abstracts for the week of October 7th, 2018 - October 13th, 2018

Student Dynamics
Monday, October 08, 2018, 3:00pm-4:00pm
1060 East Hall
Feng Zhu (University of Michigan)
Counting simple geodesics, part II: ergodicity and equidistribution in PML

Last week, we considered the question of counting simple closed geodesics on a hyperbolic surface. Bradley told us that to answer this question it is helpful to think in the moduli space of all hyperbolic structures on a surface, and presented some cool and useful tools that Maryam Mirzakhani crafted which help us do that. This week, I will present another useful tool---PML, a compact space naturally associated to the set of simple curves on our surface---and sketch the rest of the story of how Mirzakhani addressed the question.

Complex Analysis, Dynamics and Geometry
Monday, October 08, 2018, 4:00pm-5:00pm
3088 East Hall
Thomas Silverman (Brown University)
A non-archimedean lambda-lemma

In a celebrated paper published in 1983, R. Mane, P. Sad, and D. Sullivan prove a result about holomorphic families of injections called the lambda-Lemma with impressive applications to the complex dynamics of families of one-variable rational functions. In this talk, I will discuss a framework for studying the dynamics of families of one-variable rational functions parametrized by Berkovich spaces over a complete non-archimedean field and a suitable non-archimedean analogue of the lambda-Lemma. I will explain how this can be used to prove the equivalence of two stability conditions in non-archimedean dynamics and also provide some interesting examples of non-archimedean families.

Geometry & Physics
Monday, October 08, 2018, 4:00pm-5:00pm
4096 East Hall
Felix Janda (UM)
Log GLSM moduli space
For many students, college-level mathematics courses stand as barriers to success and there is fertile ground for examining how mathematics teaching should adapt in order to increase equity and inclusion. Addressing gaps in prerequisite content knowledge is an important first step and I will share successes and lessons learned from the 2014-2018 FIPSE (Fund for the Improvement of Postsecondary Education) multi-institution project "Developing Just-In-Time Mathematics Support to Increase STEM Completion," which involved the integration of online math review modules into introductory mathematics, chemistry, and physics courses. I will also argue that such interventions must be accompanied by strategies that support students in areas outside of content knowledge and I will share approaches that have the potential to increase student confidence, engagement, and self-efficacy.
Mariam Session Description and Goals:

Though the University of Michigan aspires to cultivate a climate that is welcoming to the members of its diverse student, faculty, and staff bodies, we know that the lived experiences of many in our communities don't always align with these aspirations. Join the CRLT Players for Cuts: Responding to Student Climate Concerns which invites participants to think together about the many forces that can shape campus climate both positively and negatively. Comprised of a series of vignettes focused on a Muslim student over a year as she encounters multiple issues of bias, the sketch depicts how such incidents build up over time to create a negative climate for targeted students. Discussion focuses on exploring the issues, as well as potential responses to them.

In the Mariam session, participants will:

- Analyze a series of bias incidents from the perspective of a targeted student
- Reflect on their own experiences of marginalizing behavior— as target, aggressor, or bystander
- Explore strategies for intervening effectively when they observe marginalizing behavior and for responding productively when a concern about their own behavior is raised

Audience Quotes:

"It's compelling to see these behaviors acted out, rather than just discussing hypotheticals. It's also useful to hear and practice using the language of inclusive teaching. The session leader was really a role model in that way."

"It was valuable seeing how students can express challenges differently, thinking about how to work with anger, and hearing instructors' perspectives on different ways of taking action."

"Beautiful work! So difficult and so important. Great job."
Student Arithmetic
Wednesday, October 10, 2018, 3:00pm-3:50pm
3866 East Hall
Harry Richman (University of Michigan)
Introduction to p-adic geometry

To understand rational points on a variety $X$ it often helps to first understand the geometry and topology of $X$ over various completions of the rational numbers. For archimedean completions, there is a nice topology coming from the complex numbers. For p-adic completions, the "correct" topology is not so obvious since the p-adic norm induces a topology that is totally disconnected (i.e. not so nice). In this talk we will describe a nice topological space (i.e. path connected, locally compact, Hausdorff) associated to a p-adic variety constructed by Berkovich, and look at some examples when $X$ is a curve.

Financial/Actuarial Mathematics
Wednesday, October 10, 2018, 4:00pm-5:00pm
1360 East Hall
Ibrahim Ekren (Florida State University)
Equilibrium option price with competing market makers

In this talk, we present a market equilibrium between $N$ option market makers that compete for the orders of their clients. The market makers face market illiquidity when trading the stock and manage their inventory optimally. In this framework, we exhibit a Nash equilibrium for the interaction of the agents and compute the equilibrium price of the option.
This is an ongoing work with Sergey Nadtochiy and Yavor Stoev, based on previous work with Peter Bank and Johannes Muhle-Karbe.

Algebraic Geometry
Wednesday, October 10, 2018, 4:00pm-5:20pm
4096 East Hall
Bill Fulton (U Michigan)
Determinants and Pfaffians

The formula for the cohomology class of the locus where a map between vector bundles has at most a given rank was developed from 1849 to 1974. It is a determinant of a matrix of polynomials in Chern classes of the two bundles, given by Giambelli in 1904. The study of symmetric and skew-symmetric bundle maps can be traced back to 1862, but for these with quite a variety of different formulas have been found. Only recently has it become clear that formulas for these loci are best given by pfaffians. These two talks will sketch some of this history, and describe some of the interesting algebra and combinatorics involved in the formulas. As time permits, we'll discuss how these ideas can be used to construct Schubert polynomials in types A, B, C, and D.
Student Homotopy Theory  
Thursday, October 11, 2018, 1:00pm-2:30pm  
2866 East Hall  
Attilio Castano (University of Michigan)  
*Categorifying Algebra*

In this talk we will investigate what would happen if we were to replace sets by spaces at the very foundations of mathematics. In particular, we will focus on what consequences this would have for algebra, if we were to do such a bold operation. We will begin by discussing fibered categories, one of Grothendieck's greatest insights into homotopy theory, and its further development by Jacob Lurie to the setting of higher categories. We will then proceed to use this tool to categorify what we think "doing algebra" is, and to investigate what would happen with abelian groups if sets were to be replaced by spaces.

Topology  
Thursday, October 11, 2018, 3:00pm-4:00pm  
3088 East Hall  
Jenny Wilson (U(M))  
*Quillen's approach to homological stability*

In this (partly expository) talk, I will survey homological stability phenomena in topology and group theory. I will describe a classical strategy due to Quillen for establishing that a family of groups is homologically stable. In work joint with Jeremy Miller and in part with Peter Patzt, we applied a representation-theoretic adaptation of this strategy to prove stability results for families such as configuration spaces of points in a manifold, and congruence subgroups of linear groups and of mapping class groups.
Suppose that $W_1, W_2, \ldots, W_d$ are subspaces of an $n$-dimensional $K$-vector space and let $J_1, J_2, \ldots, J_d$ in $K[x_1, x_2, \ldots, x_n]$ be the vanishing ideals of $W_1, W_2, \ldots, W_d$. Conca and Herzog showed that the Castelnuovo-Mumford regularity of the product of these ideals is equal to $d$. Derksen and Sidman showed that the Castelnuovo-Mumford regularity of the intersection of these ideals is at most $d$. In my work I show that analogous results hold when we replace the polynomial ring with the exterior algebra and work over a field of characteristic 0. The proofs of aforementioned theorems rely on the existence of non-zero divisors, so this approach fails for the exterior algebra. Instead, we rely on the functoriality of free resolutions and construct a functor $F$ from the category of polynomial functors to itself. The functor $F$ transforms resolutions of ideals in the polynomial ring into resolutions of ideals in the exterior algebra.

The Ericksen-Leslie system is the governing equation that describes the hydrodynamic evolution of nematic liquid crystal materials, first introduced by J. Ericksen and F. Leslie back in 1960's. It is a coupling system between the underlying fluid velocity field and the macroscopic average orientation field of the nematic liquid crystal molecules. Mathematically, this system couples the Navier-Stokes equation and the harmonic heat flow into the unit sphere. It is very challenging to analyze such a system by establishing the existence, uniqueness, and (partial) regularity of global (weak/large) solutions, with many basic questions to be further exploited. In this talk, I will report some results we obtained from the last few years.
Applied Interdisciplinary Mathematics (AIM)

Friday, October 12, 2018, 3:00pm-4:00pm
1084 East Hall

Saverio Spagnolie (University of Wisconsin)

Active matter invasion of a viscous fluid and a no-flow theorem

Suspensions of swimming bacteria in fluids exhibit incredibly rich behavior, from organization on length scales much longer than the individual particle size to mixing flows and negative viscosities. We will discuss the dynamics of hydrodynamically interacting motile and non-motile stress-generating swimmers or particles as they invade a surrounding viscous fluid, modeled by coupled equations for particle motions and viscous fluid flow. Depending on the type of self-propulsion by its constituents, colonies of swimmers can either exhibit a dramatic splay, or instead a cascade of transverse concentration instabilities as the group moves into the bulk. An active slender-body approximation will be introduced and used in a linear stability analysis of concentrated line distributions of particles, matching the results of our full numerical simulations. Along the way we will prove a very surprising "no-flow theorem": particle distributions initially isotropic in orientation lose isotropy immediately but in such a way that results in no fluid flow "anywhere" and "at any time".

Geometry

Friday, October 12, 2018, 3:00pm-4:00pm
3866 East Hall

Mark Greenfield (U Michigan)

Metrics and compactifications of Teichmueller spaces of flat tori

Using the identification of the symmetric space SL(n,R)/SO(n) with the Teichmueller space of flat n-tori, one can study several interesting metrics and compactifications of these spaces, drawing inspiration both from Teichmueller theory and symmetric spaces. In this talk, we will define and study an analog of the Thurston metric, as well as a Thurston-type compactification of these Teichmueller spaces.