<table>
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<tr>
<th>Date</th>
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<th>Event</th>
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<td>Monday, October 02, 2017</td>
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<td>TBA -- TBA Mason Hall</td>
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<td>Tuesday, October 03, 2017</td>
<td>11:30am-1:00pm</td>
<td><strong>Special Events</strong> -- ()</td>
<td>IBL Lunch -- 4866 East Hall</td>
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<td>The Development of Shocks in Compressible Fluids -- 1360 East Hall</td>
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<td><strong>RTG Seminar on Geometry, Dynamics and Topology</strong> -- Harrison Bray (U Michigan)</td>
<td>Lyapunov Exponents in Hilbert Geometry - continued -- 3866 East Hall</td>
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<td><strong>Commutative Algebra</strong> -- Linquan Ma (University of Utah)</td>
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<td>The braid index and the fractional Dehn twist coefficient -- 1866 East Hall</td>
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<td><strong>Differential Equations</strong> -- Demetrios Christodoulou (ETH Zurich, Switzerland)</td>
<td>The Analysis of the Shock Development Problem -- 4088 East Hall</td>
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<td><strong>Preprint Algebraic Geometry Seminar</strong> -- Takumi Murayama (UM)</td>
<td>Rational singularities (following Kovacs) -- 1866 East Hall</td>
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<td><strong>Applied Interdisciplinary Mathematics</strong></td>
<td>Xiaoming Mao (University of Michigan, Physics) Elastic networks and topological mechanics</td>
<td>1084 East Hall</td>
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<td>Harrison Bray (U Michigan) VOLUME AND ENTROPY FOR HILBERT GEOMETRIES</td>
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<td>Ashwath Rabindranath (UM) TBA</td>
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<td>4:00pm-6:00pm</td>
<td><strong>Geometry &amp; Physics</strong></td>
<td>Jie Zhou () From classical Weierstrass elliptic functions to quantum invariants</td>
<td>4096 East Hall</td>
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<td>4:00pm-5:30pm</td>
<td><strong>Arithmetic Geometry Learning Seminar</strong></td>
<td>Andrew ODesky (UM) Formal modules</td>
<td>1866 East Hall</td>
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<tr>
<td>4:00pm-5:00pm</td>
<td><strong>Junior Colloquium Series</strong></td>
<td>Visu Makam (University of Michigan) Linear matrices and their applications</td>
<td>3096 East Hall</td>
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<td>4:10pm-5:00pm</td>
<td><strong>Combinatorics</strong></td>
<td>Christin Bibby (U. Michigan) A generalization of Dowling lattices</td>
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Abstracts for the week of October 1st, 2017 - October 7th, 2017

Quant Program Practitioner Seminar  
Monday, October 02, 2017, 2:30pm-4:00pm  
TBA Mason Hall  
Ali Hirsa (Columbia University)  
TBA

Complex Analysis, Dynamics and Geometry  
Monday, October 02, 2017, 4:00pm-5:00pm  
3096 East Hall  
Kenneth Jacobs (Northwestern)  
A New Invariant in Complex Dynamics

Motivated by recent results in arithmetic dynamics, we will introduce a new invariant attached to a rational map $f$ defined over the complex numbers. Its construction depends on an auxiliary equivariant -- a function on real hyperbolic 3 space -- which also appears to carry information about the dynamics of the map $f$. In this talk, we will discuss what is known about these objects, both in the setting of complex dynamics and in the setting of arithmetic dynamics.

Geometry & Physics  
Monday, October 02, 2017, 4:00pm-6:00pm  
4096 East Hall  
Bohan Fang (Beijing International Center of Mathematical Science)  
Oscillatory integrals on T-dual branes

I will describe how to compute oscillatory integrals on T-dual branes in the LG model mirror to a toric variety. The result is a genus-0 descendant Gromov-Witten potential. By identifying this T-dual brane with a Lefschetz thimble one can obtain the asymptotic expansion of this potential, and relates to the Gamma II conjecture which concerns the asymptotic expansion of solutions to the quantum differential equations.
Integrable Systems and Random Matrix Theory  
Monday, October 02, 2017, 4:00pm-5:00pm  
1866 East Hall  
Brad Rodgers (University of Michigan)  
*Products of random matrices, and an application to Rudin-Shapiro polynomials*

This talk will discuss the distribution of products random matrices drawn from a classical compact group. We hope to discuss both the case of products of i.i.d. matrices -- with a classical and beautiful characterization of the limiting distribution due to Kawada and Ito -- along with some recent work on products of weakly dependent random matrices, which were used to resolve conjectures of Saffari and Montgomery on the distribution of Rudin-Shapiro polynomials.

Student Combinatorics Seminar  
Monday, October 02, 2017, 4:00pm-5:00pm  
3866 East Hall  
Viswambhara Makam (University of Michigan)  
*Tensor rank of determinant and permanent*

Tensor rank is a straightforward generalization of matrix rank. It gained popularity ever since people realized that the tensor rank of the matrix multiplication tensor more or less determines the complexity of matrix multiplication. I will discuss two important families of tensors, namely the determinant and permanent tensors. I will deal primarily with small cases and hope to convince you that even though the situation becomes complicated very quickly, there is potential for progress.

Group, Lie and Number Theory  
Monday, October 02, 2017, 4:10pm-5:30pm  
4088 East Hall  
Ju-Lee Kim (MIT)  
*Jordan Decompositions of cocenters of reductive p-adic groups*

Cocenters of Hecke algebras play an important role in studying mod $\ell \equiv 0$ or $\mathbb{C}$ harmonic analysis on connected $p$-adic reductive groups. On the other hand, the depth $r$ Hecke algebra is well suited to study depth $r$ smooth representations. In this paper, we study depth $r$ rigid cocenters of a connected reductive $p$-adic group over rings of characteristic zero or $\ell \not\equiv p$. More precisely, under some mild hypotheses, we establish a Jordan decomposition of the depth $r$ rigid cocenter, hence find an explicit basis of depth $r$-rigid cocenters.
The first IBL lunch of the semester will be on Tuesday, October 3 (a week from today) from 11:30am-1PM. It will take place in the faculty lounge (4866 EH), and you should feel free to come for any length of time. Lunch will be provided.

Hope to see some of you there!

Student Geometry/Topology
Tuesday, October 03, 2017, 3:00pm-4:00pm
1866 East Hall
Gilyoung Cheong (University of Michigan)
Computing Euler characteristic of configuration space of points, using zeta functions

Computing homology of the (unordered) configuration space of fixed number of points on a topological space is a classical problem in topology, going all the way back to V.I. Arnol'd and his students in 1970's. In this talk, we will first briefly discuss some known results mainly focusing on the case when the given topological space is an orientable manifold. Then we will see how to relate the Euler characteristics of the configuration spaces to that of the symmetric powers, mainly using combinatorial ideas given by R. Vakil and M.M. Wood about motivic zeta function of an algebraic variety.

If time permits, we will discuss what are the limitations of the zeta function method and try to come up with some sounding conjectures together. This talk will be extremely elementary, so whomever taken introductory algebra and topology courses should be able to follow.

Student Commutative Algebra
Tuesday, October 03, 2017, 3:00pm-4:00pm
4088 East Hall
Matt Stevenson (University of Michigan)
Abhyankar valuations are quasi-monomial, II

This is the second of two talks devoted to a theorem of Ein-Lazarsfeld-Smith, which states that Abhyankar valuations are quasi-monomial. After briefly recalling the definitions introduced in the previous talk, we will define quasi-monomial valuations and present the proof of the theorem of Ein-Lazarsfeld-Smith. Time permitting, we will discuss some applications.
The lecture shall trace the history of the theoretical study of the formation and evolution of shocks in compressible fluids, starting with the fundamental work of Riemann, the first work on nonlinear hyperbolic partial differential equations. Riemann considered the case of plane symmetry where the problem reduces to 1 spatial dimension. One milestone in the development of the theory was the work of Sideris who gave the first general proof of the finite time breakdown of smooth solutions in 3 spatial dimensions. Another milestone was the work of Majda who first addressed the problem of the local in time continuation of a shock front as a nonlinear free boundary problem for a nonlinear hyperbolic system of partial differential equations. I shall then discuss my own work, which uses differential geometric methods and resolves the resulting singularities giving a complete description in terms of smooth functions. My first work studies the maximal smooth development of given smooth initial data, the boundary of the domain of this development, and the behavior of the solution at this boundary. The boundary contains certain singular hypersurfaces which originate from certain singular surfaces. The singular surfaces do occur in nature, but not the singular hypersurfaces. My second work studies the physical evolution beyond the singular surfaces by solving a nonlinear free boundary problem with singular initial conditions associated to each of the singular surfaces. From each singular surface a shock hypersurface issues which appears as the corresponding free boundary.

Student Arithmetic
Wednesday, October 04, 2017, 3:00pm-4:00pm
3866 East Hall
Karen Butt (UM)
TBA
Financial/Actuarial Mathematics  
**Wednesday, October 04, 2017, 4:00pm-5:00pm**  
1360 EH East Hall  
Zhou Zhou (UM)  
*Optimal Equilibrium for Time-Inconsistent Stopping Problems*

We study an infinite-horizon optimal stopping problem under non-exponential discounting. A new method, which we call the iterative approach, is developed to find subgame perfect Nash equilibriums. When the discount function induces decreasing impatience, we establish the existence of an equilibrium through fixed-point iterations. Moreover, we show that there exists a unique optimal equilibrium, which generates larger value than any other equilibrium does at all times. To the best of our knowledge, this is the first time a dominating subgame perfect Nash equilibrium is shown to exist in the literature of time-inconsistency.

RTG Seminar on Geometry, Dynamics and Topology  
**Wednesday, October 04, 2017, 4:00pm-5:30pm**  
3866 East Hall  
Harrison Bray (U Michigan)  
*Lyapunov Exponents in Hilbert Geometry - continued*

Any bounded convex domain in projective space admits a Finsler metric preserved by projective transformations called the Hilbert metric. This metric is Riemannian only when the domain is the ellipsoid, in which case one recovers the Beltrami-Klein model of hyperbolic space. We are interested in the Hilbert geodesic flow of compact quotients of these domains by discrete, torsion free groups of projective transformations. In the talk we discuss a result of Mickael Crampon which describes the Lyapunov exponents of this geodesic flow in terms of the Holder regularity of the boundary of the domain.

Algebraic Geometry  
**Wednesday, October 04, 2017, 4:10pm-5:30pm**  
4096 East Hall  
Roya Beheshti Zavareh (Washington University, St. Louis)  
*The geometry of moduli spaces of rational curves on hypersurfaces*

I will talk about the geometry of moduli spaces of rational curves (and stable maps) on Fano hypersurfaces and discuss some results concerning their dimension and birational geometry.
Commutative Algebra
Thursday, October 05, 2017, 3:00pm-4:00pm
4088 East Hall
Linquan Ma (University of Utah)

Perfectoid test ideals

Inspired by the recent solution of the direct summand conjecture of Andre and Bhatt, we introduce perfectoid multiplier/test ideals in mixed characteristic. As an application, we obtain a uniform bound on the growth of symbolic powers in regular rings of mixed characteristic analogous to results of Ein-Lazarsfeld-Smith and Hochster-Huneke in equal characteristic. This is joint work with Karl Schwede.

Topology
Thursday, October 05, 2017, 3:00pm-4:00pm
1866 East Hall
Diana Hubbard (UM)

The braid index and the fractional Dehn twist coefficient

The braid index of a knot is the least number of strands necessary to represent the knot as a closure of a braid. If we view a braid as an element of the mapping class group of the punctured disk, its fractional Dehn twist coefficient (FDTC) measures the amount of twisting it exerts about the boundary. In this talk I will discuss joint work with Peter Feller showing that if a braid has FDTC greater than n-1, then its corresponding knot is of minimal braid index, which draws a connection between braids as topological and geometric objects.
The study of the physical evolution of a compressible fluid beyond the point where surfaces in spacetime appear where the derivatives of the physical variables blow up leads to the shock development problem. This is a free boundary problem for a quasilinear hyperbolic system of partial differential equations, with nonlinear conditions at the free boundary, the shock hypersurface, and with initial conditions on a transversal characteristic hypersurface which are singular at its past boundary, which is at the same time the past boundary of the shock hypersurface. My recent work solves this problem by introducing two new geometric methods and one new analytic method. The first geometric method transforms the problem into a problem of two coupled differential systems on a manifold, the first of which is fully nonlinear. What is achieved by this transformation is a complete regularization of the problem. The second geometric method is concerned with the derivation of energy identities for free boundary problems and features vectorfields in the role of variation fields. The analytic method is designed to overcome the difficulties arising from the severely singular integrals appearing as error integrals in the energy identities.

Preprint Algebraic Geometry Seminar
Thursday, October 05, 2017, 4:10pm-5:30pm
1866 East Hall
Takumi Murayama (UM)
Rational singularities (following Kovacs)

Applied Interdisciplinary Mathematics  
**Friday, October 06, 2017, 3:00pm-4:00pm**  
1084 East Hall  
**Xiaoming Mao (University of Michigan, Physics)**  
Elastic networks and topological mechanics

In this talk we introduce the concept of elastic networks, which are network models with mechanical interactions, and discuss how these network models have been widely used in soft matter physics and materials science to understand interesting phenomena of mechanics. We will then focus on elastic networks that exhibit topological edge floppy modes, which belong to the new field of “topological mechanics”. We will discuss our recent work on applying ideas from topological mechanics to design novel mechanical metamaterials with exotic properties, such as being able to switch from hard to soft, and switch back again.

Geometry  
**Friday, October 06, 2017, 3:00pm-5:00pm**  
3866 East Hall  
**Harrison Bray (U Michigan)**  
VOLUME AND ENTROPY FOR HILBERT GEOMETRIES

We prove that for any closed manifold M admitting a constant curvature hyperbolic metric, there is a lower bound on the Hilbert volume of convex projective structures on M. Moreover, the volume growth entropy decreases to 0 if the Hilbert volume of the convex projective structures on M grows without bound. In dimension three, these results are an application of a volume-entropy rigidity theorem following the classical work of Besson-Courtois-Gallot. This is joint work with Ilesanmi Adeboye and David Constantine.

Student Representation Theory  
**Friday, October 06, 2017, 3:00pm-4:00pm**  
1866 East Hall  
**Gabriel Frieden (University of Michigan)**  
TBA

Student Algebraic Geometry  
**Friday, October 06, 2017, 3:10pm-4:00pm**  
3096 East Hall  
**Ashwath Rabindranath (UM)**  
TBA
I will talk about a joint work with Si Li on the computation of higher genus B-model for elliptic curves.

I will first formulate the Feynman amplitudes in the higher genus B-model (Kodaira-Spencer theory) in terms of cohomological parings. Then I will discuss properties of the Feynman amplitudes, including the origin of their quasi-modularity, the geometric interpretation of their modular completions, etc. Finally I explain the implication of the cohomological reformation in renormalization.

Our method mainly uses the basic theory of algebraic curves. It applies to a large class of two-dimensional conformal field theories and can hopefully find application in Eynard-Orantin topological recursion as well.
Abstract: A linear matrix is a matrix whose entries are linear expressions in a number of indeterminates. We can define a commutative rank as well as a non-commutative rank on linear matrices. Analyzing the combinatorics of several intermediate ranks that we define, we are able to efficiently compute the non-commutative rank. Notable applications include an efficient algorithm for non-commutative rational identity testing, polynomial bounds for the generators of various invariant rings associated to quivers, and equations for the border rank of tensors. This is joint work with Derksen.

We are interested in certain arrangements of subvarieties on which a wreath product group acts. We give a combinatorial description of its poset of layers (connected components of intersections) as a generalization of a Dowling lattice. While these posets are not in general lattices, they still share several nice properties with Dowling and partition lattices. This combinatorial structure is an aid in understanding the cohomology of the complement as a representation of the group. Joint work with Nir Gadish.

Student AIM Seminar
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1084 East Hall
Leighton Wilson (University of Michigan)
TBA