

Fall 2008
University of Michigan-Department of Mathematics
<http://www.math.lsa.umich.edu/seminars/index.shtml>
Ann Arbor, MI 48109-1043
October 27th – November 2nd

Monday, October 27

- 3:10-4:00pm **Geometric Function Theory Seminar (Special Seminar)** --- Marc Bourdon (Universite des Sciences et Technologies de Lille) *Word hyperbolic Coxeter groups and quasi-conformal geometry* --- 4096 EH
- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Eugene Eisenstein (UM) *MRC Quotients* --- 2866 EH
- 3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- Moshe Adrian (Maryland) *Revisiting the local Langlands conjecture for $GL(2)$* --- 4096 EH
- 4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- Mattias Jonsson (UM) *Integrability in holomorphic dynamics* --- 3096 EH
- 4:10-5:00pm **Student Combinatorics** --- Ryan Kinser (UM) *$n!$ -conjecture and Macdonald positivity* --- 3866 EH
- 5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3096 EH

Tuesday, October 28

- 2:10-3:00pm **"What is ... " Seminar** --- Mark Rudelson (U of Missouri) *What is ... distance between two convex bodies?* --- 3096 EH
- 3:10-4:00pm **Geometry Seminar** --- Alexander Gorodnik (U Bristol) TBA --- 4096 EH
- 3:10-4:00pm **Algebra Seminar** --- TBA --- 3096 EH
- 3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH
- 4:10-5:00pm **Colloquium** --- Mark Rudelson (U of Missouri) *Invertibility of random matrices* --- 1360 EH
- 4:10-5:00pm **Student AIM Seminar** --- TBA --- 3088 EH
- 5:00-6:00pm **Social Hour** --- Upper Atrium

Wednesday, October 29

- 3:10-4:00pm **Geometric Function Theory Seminar** --- Zair Ibragimov (CSU, Fullerton) *Gromov hyperbolic spaces with prescribed boundaries* --- 4096 EH
- 3:10-4:00pm **Student Representation Theory Seminar** --- Chelsea Walton (UM) *An algebraic structure connected with the Yang-Baxter question* --- 3096 EH
- 3:10-4:00pm **Student Arithmetic Seminar** --- Hester Graves (UM) *The Continued Fraction of $p/q - 1/Nq^2$* --- 3866 EH
- 4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Not meeting this week --- 3096 EH

Thursday, October 30

- 2:10-3:00pm **Algebraic Geometry Seminar (Note: Special Time/Day)** --- Mihai Paun (Nancy) *Extension of pluricanonical forms and non-vanishing (Part 1)* --- 3096 EH
- 3:10-4:00pm **Algebraic Geometry Seminar (Note: Special Time/Day)** --- Mihai Paun (Nancy) *Extension of pluricanonical forms and non-vanishing (Part 2)* --- 3866 EH
- 3:10-4:00pm **Commutative Algebra Seminar** --- Not meeting this week --- 3096 EH
- 3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- TBA --- 3088 EH
- 3:10-4:00pm **Topology Seminar** --- Rick Jardine (U of Western Ontario) *Cocycle categories* --- 4096 EH
- 4:10-5:00pm **Colloquium (Special Colloquium)** --- Rahul Pandharipande (Princeton) *Algebraic Cobordism* --- 1360 EH
- 4:10-5:00pm **Differential Equations** --- Ning Jiang (NYU) *Some recent progress on the hydrodynamic limits from Boltzmann equation* --- 4088 EH
- 4:10-6:00pm **Geometry and Physics Seminar** --- Not meeting this week --- 4096 EH

Thursday, October 30 ... continued

- 4:10-5:00pm **Math Club** --- Dan Hermes (UM) *Life of PI: Continued Fractions and Infinite Series* --- 2nd floor Nesbitt Common Room
- 4:10-5:00pm **Reading Group in Probabilistic Methods in Geometric Functional Analysis and Combinatorics** --- Not meeting this week --- 3096 EH
- 4:10-6:00pm **RTG Study Seminar** --- Aaron Magid (UM) *One-parameter families of hyperbolic manifolds* --- 3866 EH

Friday, October 31

- 11:10-12:00pm **Theoretical Computer Science Seminar** --- Denny VandenBerg (UM) TBA --- Room TBD
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Eric Michielssen (UM) *Calderon-Enhanced Time Domain Integral Equation Solvers* --- 1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- Not meeting this week --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Eran Nevo (Cornell) *On the g-conjecture* --- 3866 EH

SPECIAL EVENTS THIS WEEK

**Great Lakes Geometry Conference
University of Michigan, Ann Arbor
Oct 31 - Nov 2, 2008**

Friday October 31, 2008

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|-----------|------------------------------|--|
| 3:00-4:00 | R. Pandharipande (Princeton) | Counting curves on K3 surfaces |
| 4:00-4:30 | Coffee break | |
| 4:30-5:30 | C. Leininger (Illinois) | Mapping class groups and curve complexes |

Saturday November 1, 2008

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|-------------|---------------------------|---|
| 9:00-9:30 | Coffee and pastry | |
| 9:30-10:30 | Y. Eliashberg (Stanford) | Surgery formulas for contact and symplectic homology |
| 10:30-11:00 | Coffee break | |
| 11:00-12:00 | R. Fintushel (MSU) | Cyclic group actions on simply connected 4-manifolds |
| 12:00-2:00 | Lunch break | |
| 2:00-3:00 | T. Jarvis (BYU) | The Witten equation, mirror symmetry and quantum singularity theory |
| 3:00-3:30 | Coffee break | |
| 3:30-4:30 | T.-J. Li (Minnesota) | Some topological aspects of birational symplectic geometry |
| 4:30-5:00 | Coffee break | |
| 5:00-6:00 | M. Mirzakhani (Princeton) | TBA |
| 6:30- | Banquet at Middle Kingdom | |

Sunday November 2, 2008

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|-------------|----------------------------|--|
| 9:00-9:30 | Coffee and pastry | |
| 9:30-10:30 | Y. Minsky (Yale) | Weil-Petersson geodesics, bounded geometry and bounded combinatorics |
| 10:30-10:45 | Coffee break | |
| 10:45-11:45 | A. Li (Sichuan University) | TBA |
| 11:45-12:00 | Coffee break | |
| 12:00-1:00 | K. Hori (Toronto) | TBA |

ABSTRACTS FOR THE WEEK OF OCT. 27 – NOV. 2, 2008

Geometric Function Theory Seminar (Special Seminar)

Monday, October 27, 3:10-4:00pm

4096 EH

Marc Bourdon (Universite des Sciences et Technologies de Lille)

Word hyperbolic Coxeter groups and quasi-conformal geometry

We are interested in word hyperbolic Coxeter groups. We show that invariant structures on their boundaries can be described using the parabolic subgroups. We study quasi-conformal geometry of their boundaries in relation with the parabolic subgroups. This is a joint work with B. Kleiner.

Group Theory/Lie Theory/Number Theory Seminar

Monday, October 27, 3:10-5:00pm

4096 EH

Moshe Adrian (Maryland)

Revisiting the local Langlands conjecture for $GL(2)$

The study of the Local Langlands Correspondence for $GL(2, F)$, where F is a local field, was initiated by Jacquet-Langlands in 1970; many people contributed since their work, but Kutzko, bringing several new ideas to the subject, completed the proof. In the tame case, supercuspidal representations correspond to certain characters of elliptic tori, but the correspondence is unnatural because it involves a twist by some character of the torus. Taking the cue from the Langlands correspondence for discrete series over the reals, the Local Langlands correspondence for supercuspidal representations should instead have something to do with characters of covers of tori. Stephen DeBacker has calculated the character formulas of supercuspidal representations for $GL(n)$, n a prime. Part of my goal is to simplify his formulas using characters of covers of elliptic tori. This will hopefully shed light on the character twists in the correspondence for $GL(2)$, and thereby give a more natural way of constructing the correspondence.

Several Complex Variables and Complex Dynamics Seminar

Monday, October 27, 4:10-5:00pm

3096 EH

Mattias Jonsson (UM)

Integrability in holomorphic dynamics

Integrability for a dynamical system means that some quantity is preserved by the dynamics. I will survey some aspects of this notion in (discrete-time) holomorphic dynamics, with emphasis on holomorphic selfmaps of the complex projective plane.

Student Combinatorics

Monday, October 27, 4:10-5:00pm

3866 EH

Ryan Kinser (UM)

$n!$ -conjecture and Macdonald positivity

We continue our study of Hilbert schemes of points in the plane, and consider the relation to symmetric functions and Macdonald polynomials.

“What is ... ” Seminar
Tuesday, October 28, 2:10-3:00pm
3096 EH

Mark Rudelson (U of Missouri)
What is ... distance between two convex bodies?

How different are two convex bodies? To compare them, we want to be able to put one on top of another. Frequently, we also want to view a convex body independently of the coordinate structure of the ambient space. This means that our measure of the difference should be invariant under shifts and linear transformations. We consider a notion of distance, which naturally arises in asymptotic geometric analysis, and discuss how to evaluate distances between high-dimensional convex bodies.

Colloquium
Tuesday, October 28, 4:10-5:00pm
1360 EH

Mark Rudelson (U of Missouri)
Invertibility of random matrices

We will discuss several recent developments related to invertibility and spectral properties of large random matrices. Consider an $n \times n$ matrix, whose values are independent identically distributed random variables. The invertibility questions can be roughly divided in two categories.

- Qualitative problems.
 - What is the probability that a random matrix is invertible? This probability is obviously 1, if the entries are absolutely continuous. However, in the case of discrete entries the problem becomes highly non-trivial.
- Quantitative problems.
 - What is the typical distance between a random matrix and the set of singular matrices?
 - How is this distance distributed?

 We will briefly survey recent results concerning the qualitative questions. Most of the talk will be devoted to quantitative results, which are usually more involved. In particular, we will describe recent solutions of the von Neumann and Spielman--Teng conjectures about the behavior of the least singular value. Applications of these results to classical random matrix theory will also be considered.

Geometric Function Theory Seminar
Wednesday, October 29, 3:10-4:00pm
4096 EH

Zair Ibragimov (California State University, Fullerton)
Gromov hyperbolic spaces with prescribed boundaries

Given a complete perfect metric space, we construct a Gromov hyperbolic space $Gr(X)$ having X as its boundary at infinity. We show that there is a homomorphic extension operator from the group of quasisymmetric maps on X to the group of quasiisometric maps on $Gr(X)$. As an application, we obtain a conformally natural homomorphic extension of quasisymmetric groups of the real line into the quasiisometric groups of the upper half plane. We also show that the chordal metrics on X are the visual metrics. Our construction was inspired by the hyperbolic cone construction of M. Bonk and O. Schramm.

Student Arithmetic Seminar
Wednesday, October 29, 3:10-4:00pm
3866 EH

Hester Graves (UM)
The Continued Fraction of $p/q - 1/Nq^2$

A surprising and pretty result by Mark Sheingorn, which is shocking in its novelty.

Colloquium (Special Colloquium)
Thursday, October 30, 4:10-5:00pm
1360 EH
Rahul Pandharipande (Princeton)
Algebraic Cobordism

I will talk about a theory of cobordism for algebraic varieties defined by M. Levine and F. Morel from Quillen's axiomatic perspective. My point of view will be rather concrete with the goal of explaining a new geometric presentation of algebraic cobordism via the simplest normal crossings degenerations. Applications to computations in algebraic geometry will also be discussed. The talk is based on joint work with M. Levine.

Differential Equations
Thursday, October 30, 4:10-5:00pm
4088 EH
Ning Jiang (NYU)
Some recent progress on the hydrodynamic limits from Boltzmann equation

In this talk we address two topics: 1, In the framework of DiPerna-Lions renormalized solutions to the Boltzmann equation, we justify the incompressible Navier-Stokes limit in a bounded domain. Using the dissipative effects of the boundary layers (Knudsen layer and viscous fluid layer), the convergence is shown to be strong. 2, In the framework of classical solutions, We revisit the classical work of Caflisch for compressible Euler limit of the Boltzmann equation. By using a new L^2 method, we prove the validity of the Hilbert expansion before shock formations in the Euler system with moderate temperature variation.

Math Club
Thursday, October 30, 4:10-5:00pm
2nd floor Nesbitt Common Room
Dan Hermes (UM)
Life of π : Continued Fractions and Infinite Series

Ever wonder how π is calculated to trillions of digits? Me neither. By writing out the digits of π in decimal notation (3.1415926535 8979323846 2643383279 5028841971 6939937510 5820974944 5923078164 0628620899 8628034825 3421170679 ...) one "sees" that π is truly irrational. In this talk we'll explore a beautiful fact that makes π resemble something rational (not mathematically). In understanding the story of π we'll see just how fun numbers can be and how brilliant men thought (and think) of numbers.

RTG Study Seminar
Thursday, October 30, 4:10-6:00pm
3866 EH
Aaron Magid (UM)
One-parameter families of hyperbolic manifolds

Given a 1-parameter family of hyperbolic metrics on a manifold, one can associate a cohomology class that represents the infinitesimal change in the metric at each time throughout the deformation. This cohomology class will be a 1-form in $H^1(M;E)$ where M is the manifold and E is the bundle of Killing fields on M . Once we obtain a cohomology class, we can use the Hodge theorem to find a harmonic representative. Calabi-Weil used this to show that any infinitesimal deformation of a closed hyperbolic manifold is trivial. This discussion is motivated by Hodgson, Kerckhoff, and Bromberg's more recent work on noncompact hyperbolic manifolds. They prove a generalized Hodge theorem and use this to show that hyperbolic cone-manifolds are locally rigid relative to the cone angle.

Applied and Interdisciplinary Mathematics Seminar
Friday, October 31, 3:10-4:00pm
1084 EH
Eric Michielssen (UM)
Calderon-Enhanced Time Domain Integral Equation Solvers

Marching on in time integral equation solvers provides an appealing avenue for analyzing transient electromagnetic interactions with large and complex structures. Unfortunately, these solvers often suffer from spatial (dense-mesh) breakdown phenomena when applied to the analysis of geometrically intricate and multiscale structures. Often, they also are susceptible to low-frequency instabilities. This presentation highlights the recent development of two solvers that address these breakdown phenomena by leveraging Calderon identities. The proposed solvers are shown to robustly and seamlessly apply to important engineering problems that span multiple temporal and spatial scales.

Combinatorics
Friday, October 31, 4:10-5:00pm
3866 EH
Eran Nevo (Cornell)
On the g -conjecture

The f -vector of an abstract simplicial complex records the number of its faces in each dimension.

In 1970 McMullen conjectured a complete characterization of the possible f -vectors of boundary complexes of simplicial polytopes. These numerical conditions were proved in 1980, their necessity by Stanley and their sufficiency by Billera and Lee; known as the g -theorem. The proof of necessity shows that the hard-Lefschetz property (decomposition) holds for an appropriate ring associated with the polytope, from which the numerical consequences follow.

A major open problem in algebraic combinatorics, known as the g -conjecture, is to extend these numerical and algebraic assertions to the larger family of simplicial sphere, and even more general families.

We will indicate recent developments on this conjecture, focusing on the following results:

1. (Joint with Martina Kubitzke.) The (numerical) g -conjecture holds for the barycentric subdivision of homology spheres. This follows from the following algebraic result: An 'almost hard-Lefschetz' property holds for the barycentric subdivision of a shellable complex.
2. (Joint with Eric Babson.) If a homology sphere and one of its face links admit the hard-Lefschetz property, then its stellar subdivision at this face admits the hard-Lefschetz property, and hence satisfies the (numerical) g -conjecture. One ingredient in the proof is showing that the hard-Lefschetz property is preserved under the join operation.