

Fall 2008
University of Michigan-Department of Mathematics
<http://www.math.lsa.umich.edu/seminars/index.shtml>
Ann Arbor, MI 48109-1043
November 3rd – November 9th

Monday, November 3

- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Wenliang Zhang (UM) *Lang's Thesis* --- 2866 EH
- 3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- Loren Spice (UM) *Supercuspidal characters and applications* --- 4096 EH
- 4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- Michal Jasiczak (U of Poznan & Inst. of Mathematics Polish Acad. of Sciences) *A priori estimates for the $\overline{\partial}$ -equation on K^n -manifolds* --- 3096 EH
- 4:10-5:00pm **Student Combinatorics** --- Brian Jurgelewicz (UM) *Hall-Littlewood polynomials and the classical Hall algebra* --- 3866 EH
- 4:10-6:00pm **Geometry and Physics Seminar (Note: Non-standard day/location)** --- Kentaro Hori (Toronto) *Mirror symmetry in 2+1 and 1+1 dimensions* --- 4088 EH
- 5:15-6:30pm **Teaching Mathematics** --- Mark Conger (UM) *An Overview of the Douglass Houghton Scholars Program: Goals and Anecdotes* --- 3096 EH

Tuesday, November 4

- 2:10-3:00pm **"What is ... " Seminar** --- Kartik Prasanna (U of Maryland) *What is ... Iwasawa theory?* --- 3096 EH
- 3:10-4:00pm **Commutative Algebra (Special) Seminar (Note: non-standard day/location)** --- Adela Vraciu (U of South Carolina) *Level ideals and projective equivalence* --- 3866 EH
- 3:10-4:00pm **Geometry Seminar** --- J. Noguchi (U of Tokyo) *Holomorphic curves and rational points* --- 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** --- Kartik Prasanna (U of Maryland) *The arithmetic of special values of L-functions* --- 1360 EH
- 4:10-5:00pm **Student AIM Seminar** --- Jared Whitehead (UM) *Mathematical Methods of Climate Change* --- 3088 EH

Wednesday, November 5

- 3:10-4:00pm **Geometric Function Theory Seminar** --- Not meeting this week --- 4096 EH
- 3:10-4:00pm **Student Representation Theory Seminar** --- TBA --- 3096 EH
- 3:10-4:00pm **Student Arithmetic Seminar** --- Jonathan Bober (UM) *The Beurling-Nyman criterion for the Riemann Hypothesis* --- 3866 EH
- 4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Michal Jasiczak (U of Poznan & Inst. of Mathematics Polish Acad. of Sciences) *Division and interpolation on singular spaces* --- 3096 EH
- 4:10-6:00pm **Algebraic Geometry Seminar** --- Stein Stromme (Bergen, visiting UM) *1-skeleta and the $n!$ ring* --- 3088 EH

Thursday, November 6

- 3:10-4:00pm **Commutative Algebra Seminar** --- Kevin Tucker (UM) *Pretalk* --- 3096 EH
- 3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- TBA --- 3088 EH
- 3:10-4:00pm **Topology Seminar** --- Larry Guth (U of Toronto) *Volume and homology in the space of cycles* --- 4096 EH
- 4:10-5:00pm **Differential Equations** --- Nader Masmoudi (NYU) *Boundary layers and Homogenization* --- 4088 EH

Thursday, November 6 ... continued

- 4:10-5:00pm **Math Club** --- Anna Siano (UM) *Sir Roger Penrose and the frying pan* --- 2nd floor Nesbitt Common Room
- 4:10-5:00pm **Reading Group in Probabilistic Methods in Geometric Functional Analysis and Combinatorics** --- 3096 EH
- 4:10-6:00pm **RTG Study Seminar** --- Aaron Magid (UM) *One-parameter families of hyperbolic manifolds (cont.)* --- 3866 EH

Friday, November 7

- 11:10-12:00pm **Theoretical Computer Science Seminar** --- Kevin Matulef (UM) TBA --- Room TBD
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Melvin Leok (Purdue) *Lie Group and Homogeneous Variational Integrators and their Applications to Geometric Optimal Control Theory* --- 1084 EH
- 3:10-5:00pm **Student Geometry/Topology (Note: Special Time)** --- Michelle Lee (UM) & Nina White (UM) *Three Manifolds: Foliations and Topology* --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Kelli Talaska (UM) *Planar networks and the totally nonnegative Grassmannian* --- 3866 EH

UPCOMING EVENTS

Mathematica 6 in Education and Research
Tuesday, November 18, 2:30-4:00pm
4088 EH
Presented by: Josh Lietz (Wolfram Research)

This talk illustrates capabilities in Mathematica 6 that are directly applicable for use in teaching and research on campus. Topics of this technical talk include:

- * 2D and 3D visualization
- * Dynamic interactivity
- * On-demand scientific data
- * Example-driven course materials
- * Symbolic interface construction
- * Practical and theoretical applications

Current users will benefit from seeing the many improvements and new features of Mathematica 6 (<http://www.wolfram.com/mathematica/newin6>), but prior knowledge of Mathematica is not required.

UPCOMING EVENTS ... Continued

Ziwet Lecture Series (I, II, III)
Tuesday-Thursday, November 18-20
Speaker: Ioannis Karatzas (Columbia University)

Ziwet Lectures I (Colloquim)
Tuesday, November 18, 4:10-5:00pm
1360 EH
Stochastic Portfolio Optimization

Ziwet Lectures II
Wednesday, November 19, 3:10-4:00pm
3088 EH
Aspects of Stochastic Portfolio Theory

Ziwet Lectures III
Thursday, November 20, 3:10-4:00pm
3088 EH
Optimal Arbitrage

ABSTRACTS FOR THE WEEK OF NOV. 3 – NOV. 9, 2008

Group Theory/Lie Theory/Number Theory Seminar
Monday, November 3, 3:10-5:00pm
4096 EH
Loren Spice (UM)
Supercuspidal characters and applications

In 2000, J.-K. Yu described a construction of supercuspidal characters of general reductive p-adic groups that generalises the classical construction of Howe and Moy (and is often exhaustive, by J.-L. Kim). Together with J. Adler, we computed the characters of many of these representations using Harish-Chandra's integral formula. By analogy with the case of real groups, character formulae for p-adic groups are expected to have many applications in harmonic analysis. One important application arises in the study of the local Langlands correspondence, where one wants to be able to prove that certain combinations of characters are (loosely speaking) invariant under geometric conjugacy. We discuss joint results in this direction with S. DeBacker.

**Several Complex Variables and Complex Dynamics Seminar
Monday, November 3, 4:10-5:00pm
3096 EH**

**Michal Jasiczak (U of Poznan & Inst. of Mathematics Polish Academy of Sciences)
A priori estimates for the $\overline{\partial}$ -equation on K^a -manifolds 4:10-5:00pm**

There is a growing interest in analysis on singular spaces. While there are many ways one can understand the term 'singular space' in different branches of mathematics, in complex analysis it usually refers to a singular analytic set. The regular part of such a set is a complex manifold, which sometimes can be equipped with a complete K^a -metric (e.g. the Ohsawa metric). Motivated by this fact we intend to analyze influence of geometry of a complete K^a -manifold on regularity of the $\overline{\partial}$ -problem. More specifically, in order to obtain a priori Hölder estimates for the $\overline{\partial}$ -problem on such a manifold, we will have a look on methods introduced in real analysis by S. Campanato, C. B. Morrey, E. DeGiorgi and J. Nash. This will lead us to an interesting non-linear PDE. As a corollary, we will also obtain a 'weak version' of the Schwarz Lemma for holomorphic functions and harmonic forms on a complete K^a -manifold.

**Student Combinatorics
Monday, November 3, 4:10-5:00pm
3866 EH**

**Brian Jurgelewicz (UM)
*Hall-Littlewood polynomials and the classical Hall algebra***

The last two weeks we have been learning about MacDonalD polynomials. This week we take a step back and consider Hall-Littlewood polynomials, which have only one "parameter", instead of two. They form a basis for a certain one-parameter deformation of the ring of symmetric polynomials. Specializing at $t = 0$ gives the Schur polynomials, and $t = 1$ gives the monomial symmetric polynomials. The ring of symmetric polynomials is isomorphic to the classical Hall algebra. We will get our hands dirty by calculating a few products in the classical Hall algebra. Such calculations are equivalent to multiplications rules for HL-polynomials.

**Teaching Mathematics
Monday, November 3, 5:15-6:30pm
3096 EH**

**Mark Conger (UM)
*An Overview of the Douglass Houghton Scholars Program: Goals and Anecdotes***

The Douglass Houghton Scholars Program (DHSP) is based on the Emerging Scholars Program developed by Uri Treisman at Berkeley and the University of Texas. DHSP is in its third year, and enrolls students taking Math 115 (calculus I), who take an additional workshop in which they tackle hard calculus problems for four hours a week. The goals of the program will be discussed, as will the manner in which the program seeks to accomplish them. These will be illustrated with specific examples of the activities students work on, their achievements, and observations of the success of the workshop.

“What is ...” Seminar
Tuesday, November 4, 2:10-3:00pm
3096 EH
Kartik Prasanna (U of Maryland)
What is ... Iwasawa theory?

Iwasawa theory refers to a circle of ideas introduced by Iwasawa to study various objects of arithmetic interest (such as class groups, Galois groups, L-values etc) by putting them in families. This talk will be an introduction to some ideas in Iwasawa theory, starting from a historical point of view and leading up to more recent developments.

Commutative Algebra (Special) Seminar - (Note: non-standard day/location)
Tuesday, November 4, 3:10-4:00pm
3866 EH
Adela Vraciu (U of South Carolina)
Level ideals and projective equivalence

Let (R, m) be a local or graded Noetherian ring of positive characteristic p and Krull dimension d , and let $\mathfrak{a}, \mathfrak{l} \subset R$ be \mathfrak{m} -primary ideals.

Colloquium
Tuesday, November 4, 4:10-5:00pm
1360 EH
Kartik Prasanna (U of Maryland)
The arithmetic of special values of L-functions

L-functions are certain complex analytic functions that are generalizations of the Riemann zeta function. Conjecturally, their behavior at integer points encodes deep arithmetic information. I will give an introduction to the arithmetic of special values of L-functions (and of p-adic L-functions, their p-adic analogs) through some simple examples.

Student AIM Seminar
Tuesday, November 4, 4:10-5:00pm
3088 EH
Jared Whitehead (UM)
Mathematical Methods of Climate Change

Have you ever wondered how or if you can contribute to the science behind climate change (global warming)? Come and get a glimpse of what other mathematicians around the world are working on related to climate change. This subject touches on most sub-disciplines in applied mathematics, such as: geometry, numerical analysis, scientific computing & computer science (massively parallel machines), fluid dynamics, statistical mechanics, statistics, stochastic processes, multi-scale modeling, asymptotic methods, dynamical systems, mechanics, statics, game theory, economics, and much much more!

Student Arithmetic Seminar
Wednesday, November 5, 3:10-4:00pm
3866 EH

Jonathan Bober (UM)
The Beurling-Nyman criterion for the Riemann Hypothesis

The Beurling-Nyman criterion is a real-variable reformulation of the Riemann Hypothesis. More specifically, the Riemann Hypothesis is true if and only if a certain set of functions is dense in $L^2((0,1))$. I'll describe this, with at least partial proof, and I'll give some related examples.

RTG Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, November 5, 4:10-5:00pm
3096 EH

Michal Jasiczak (U of Poznan & Inst. of Mathematics Polish Acad. of Sciences)
Division and interpolation on singular spaces

During this talk we intend to discuss the extension and division problem for holomorphic functions and differential forms near singularities of a complex space. We will apply desingularization argument and study the case of functions and forms that vanish to high order near the singular set.

Differential Equations
Thursday, November 6, 4:10-5:00pm
4088 EH

Nader Masmoudi (NYU)
Boundary layers and Homogenization

The goal of the talk is to discuss two related problems. The first one is the homogenization in polygonal domains and the second is about the derivation of the Navier boundary condition using the theory of homogenization.

Getting higher order corrections in the theory of (periodic) homogenization requires a very good understanding about what is happening at the boundary. This leads to boundary layer problems that can be solved using a quasi-periodic setting.

For the second problem, we consider the Navier-Stokes equation in a domain with rough boundaries. The small irregularity is modeled by a small amplitude and small wavelength boundary with typical lengthscale $\epsilon \ll 1$. Using boundary layer theory, we prove that the high order approximation leads to a Navier boundary condition. This is a joint work with David Gerard-Varet and preprints are available at <ftp://ftp.dma.ens.fr/pub/reports/dma-08-14.pdf> <ftp://ftp.dma.ens.fr/pub/reports/dma-08-13.pdf>

Math Club
Thursday, November 6, 4:10-5:00pm
2nd floor Nesbitt Common Room
Anna Siano (UM)
Sir Roger Penrose and the frying pan

We will discuss the geometry of tessellation, i.e., the "art" of covering a flat surface with tiles of prescribed shape (like birds, fishes, squares, ...) so that neither gaps nor overlaps occur. Penrose noticed that certain tilings seem to have no repeating pattern. Eventually, he was able to create such a non-periodic tiling with only two different shapes: kites and darts!

And what about the frying pan?

RTG Study Seminar
Thursday, November 6, 4:10-6:00pm
3866 EH

Aaron Magid (UM)
One-parameter families of hyperbolic manifolds (cont.)

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, November 7, 3:10-4:00pm
1084 EH

Melvin Leok (Purdue)
Lie Group and Homogeneous Variational Integrators and their Applications to Geometric Optimal Control Theory

The geometric approach to mechanics serves as the theoretical underpinning of innovative control methodologies in geometric control theory. These techniques allow the attitude of satellites to be controlled using changes in its shape, as opposed to chemical propulsion, and are the basis for understanding the ability of a falling cat to always land on its feet, even when released in an inverted orientation.

We will discuss the application of geometric structure-preserving numerical schemes to the optimal control of mechanical systems. In particular, we consider Lie group variational integrators, which are based on a discretization of Hamilton's principle that preserves the Lie group structure of the configuration space. In contrast to traditional Lie group integrators, issues of equivariance and order-of-accuracy are independent of the choice of retraction in the variational formulation. The importance of simultaneously preserving the symplectic and Lie group properties is also demonstrated. Recent extensions to homogeneous spaces yield intrinsic methods for Hamiltonian flows on the sphere, and have potential applications to the simulation of geometric exact rods, structures and mechanisms.

By combining Lie group and homogeneous variational integrators with noncommutative harmonic analysis and numerical parametric uncertainty techniques, we obtain a global uncertainty propagation scheme for rigid body dynamics. This method is distinguished from prior approaches, as it allows one to consider probability densities that are global, and are not supported on only a single coordinate chart on the manifold. The use of a geometric integrator as the underlying numerical propagator ensures that the advected probability densities respect the geometric properties of uncertainty propagation in Hamiltonian systems, which arise as consequence of the Gromov nonsqueezing theorem from symplectic geometry.

Student Geometry/Topology (Note: Special Time)
Friday, November 7, 3:10-5:00pm
3096 EH
Michelle Lee (UM) & Nina White (UM)
Three Manifolds: Foliations and Topology

This will be a special 2-hour seminar (donuts and cider provided during a 10 minute break) on how foliations of 3-manifolds are useful in studying their topology. A codimension-1 foliation of a 3-manifold is a "decomposition" of your manifold into disjoint two-dimensional sheets. This visually-enticing notion (read: this talk will have lots of pictures!!) has deep implications about the topology of the 3-manifold we foliate.

The first hour will give an introduction to foliations with lots of examples and pictures, including the famous Reeb foliation of the 3-sphere. The second hour will introduce enough minimal surface theory and facts about the Euler characteristic to prove some topological results about 3-manifolds which admit certain kinds of foliations. The goal will be to sketch some version of Novikov's theorem.

Combinatorics
Friday, November 7, 4:10-5:00pm
3866 EH
Kelli Talaska (UM)
Planar networks and the totally nonnegative Grassmannian

For a planar directed graph G , Postnikov's boundary measurement map sends positive weight functions on the edges of G onto the appropriate cell in the totally nonnegative Grassmannian. We will give an explicit formula for Postnikov's map by expressing each Plücker coordinate as a ratio of two combinatorially defined polynomials in the edge weights, with positive integer coefficients. It is then easy to see that this formula generalizes Lindström's classical result for acyclic networks. If we restrict to a special class of networks corresponding to Le-tableaux, then we can also give an explicit description of the inverse map. This was done for the top dimensional cell by Speyer and Williams. Our formula, which holds for any cell, gives each entry of the Le-tableau as a ratio of certain Plücker variables.