Fall 2006
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
December 4th – December 10th

Monday, December 4

3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Julianna Tymoczko (UM) *Newton polytopes of A-discriminants* --- 3866 EH
3:10-4:30pm **Arithmetic/Number Theory Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Mattias Jonsson (UM) *Degree growth of rational surface maps* --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- Igor Dolgachev (UM) *Gromov-Witten invariants of Calabi-Yau threefolds of Enriques type* --- 3088 EH
4:10-6:00pm **Group Theory/Lie Theory Seminar** --- Not meeting this week --- 4088 EH

Tuesday, December 5

12:10-1:00pm **Student Algebraic Geometry Seminar** --- Kyle Hofmann (UM) *A Proof of Zariski's Main Theorem, following Zariski* --- 1068 EH
2:10-3:00pm **Geometry Seminar** --- Tamar Ziegler (UM) *Geometric Ramsey theory and nilpotent groups* --- 4088 EH
3:10-4:00pm **Algebra Seminar** --- Not meeting this week --- 3096 EH
4:10-5:00pm **Colloquium** --- Alexander Beilinson (Chicago) *Topological epsilon-factors* --- 1360 EH
5:00-6:00pm **Social Hour** --- Upper Atrium

Wednesday, December 6

2:10-3:00pm "**What is … " Seminar** --- Alexander Beilinson (Chicago) *What is … Chiral Homology?* --- 245 Dennison
3:10-4:00pm **Student Arithmetic Seminar** --- Matthew Smith (UM) *Roth's Theorem* --- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- Paul Shearer (UM) *Introduction to Percolation Theory on Z^d* --- 3096 EH
3:10-4:00pm **Geometric Function Theory Seminar** --- Zair Ibragimov (UM Visiting Scholar) *Diametrically maximal sets* --- 4096 EH
4:10-5:00pm **Student Analysis Seminar** --- Not meeting this week --- 3866 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Julianna Tymoczko (UM) *Permutation actions on the equivariant cohomology of Grassmannians: an introduction to geometric representation theory* --- 3088 EH

Thursday, December 7

3:10-4:00pm **Commutative Algebra Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Mingxin Xu (U of NC, Charlotte) *Risk measure pricing and hedging in incomplete markets* --- 3088 EH
3:10-4:00pm **Topology Seminar** --- Ian Leary (OSU) *Finite subgroups of VF groups* --- 4096 EH
3:10-5:00pm **Analysis Study Seminar** --- Mario Bonk (UM) *Asymptotic cones (continued)* --- 2866 EH
4:10-5:00pm **Differential Equations** --- Markus Keel (Minnesota) *Energy transfer to higher modes in a Hamiltonian nonlinear Schroedinger equation* --- 4096 EH
4:10-5:00pm **Math Club** --- Benjamin Weiss (UM) *The Generalized Factorial* --- 2nd Floor Nesbitt Room
4:10-5:00pm **Student Combinatorics** --- Austin Shapiro (UM) *Semiprimary Lattices and the Schensted Correspondence* --- 3866 EH
4:10-5:30pm **Logic Seminar** --- TBA--- 3096 EH
4:30-5:30pm **Theoretical Computer Science Seminar** --- Xiaolin Shi (UM) *Graphs over Time: Densification Laws, Shrinking Diameters and Possible Explanations* --- CSE 3941
5:15-6:30pm **Teaching Mathematics** --- Michael Weiss (UM) TBA --- 3088 EH

Friday, December 8

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Emery Brown (Harvard) *Application of the State-Space Model Paradigm to Neuroscience Data Analysis* ---1360 EH

3:10-4:00pm **Student Geometry/Topology** --- David Constantine (UM) *The Use of the Boundary at Infinity in Rigidity Theory* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Not meeting this week --- 3866 EH

4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics (**non-standard day & room) --- Anna Siano (UM) *Stability of Hölder estimates on pseudoconvex domains of finite type in C^2* --- 3096 EH

ABSTRACTS FOR THE WEEK OF DEC. 4 – DEC. 10, 2006

Several Complex Variables Seminar
Monday, December 4, 4:10-5:00pm
3096 EH
Mattias Jonsson (UM)
Degree growth of rational surface maps

A basic problem of understanding a dynamical system defined by a rational map in (say) two dimensions is to understand the growth of degrees. This problem essentially reduces to linear algebra when the map acts functorially on cohomology, which means that no curve is eventually mapped to an indeterminancy point. When the map is birational, this functorial property can be achieved after blowing up the space finitely many times but it is unknown to what extent this is possible for noninvertible maps. We circumvent this difficulty by working on the Riemann-Zariski space, an object which can be viewed as the space obtained from the projective plane by blowing up "everything". On the Riemann-Zariski space there are no indeterminancy points and this allows us to at least partially understand the degree growth of the original map.
This is joint work with Sebastien Boucksom and Charles Favre (both at CNRS, France).

Student Algebraic Geometry Seminar
Tuesday, December 5, 12:10-1:00pm
1068 EH
Kyle Hofmann (UM)
A Proof of Zariski's Main Theorem, following Zariski

The Main Theorem of a 1943 paper by Zariski states: Let V and V' be varieties, and let f : V' → V be a birational morphism. Assume that V is normal, and let P be a (not necessarily closed) point of V. If f-1(P) contains an isolated point of the same dimension as P, then f-1(P) is a set of finitely many points, all of which have the same residue field. In 1949, Zariski published a short paper, "A simple analytical proof of a fundamental property of birational transformations", Proc. Nat. Acad. Sci. U.S.A. 35, (1949) 62-66, in which he gives a proof of his Main Theorem using completions and valuations of local rings. We will present this proof, assuming only some standard facts from commutative algebra.

Geometry Seminar
Tuesday, December 5, 2:10-3:00pm
4088 EH
Tamar Ziegler (UM)
Geometric Ramsey theory and nilpotent groups

We use recently developed ergodic theoretic tools to solve a classical problem in geometric Ramsey theory. Let E be a measurable subset of R^m, with positive upper density. Let V = { 0, v_1,...,v_k } be a subset of R^m. We show that for r large enough, we can find an isometric copy of rV arbitrarily close to E. This problem translates to a multiple recurrence problem in ergodic theory, which turns out to be of an algebraic nature, involving the dynamics of translations on homogeneous spaces of nilpotent Lie groups.

Colloquium
Tuesday, December 5, 4:10-5:00pm
1360 EH
Alexander Beilinson (Chicago)
Topological epsilon-factors

A key property of arithmetic L-functions (that lies at the heart of the Langlands reciprocity) is factorization of the constants in the functional equation into a product of local epsilon-factors. In this talk I will explain a parallel topological construction which provides an epsilon factorization of the determinant of the cohomology of a constructible sheaf. It can be viewed as an "animation" of the classical Dubson-Kashiwara formula for the Euler characteristics.

Student AIM Seminar
Wednesday, December 6, 3:10-4:00pm
3096 EH
Paul Shearer (UM)
Introduction to Percolation Theory on Z^d

Let L^d be the graph on the vertex set Z^d where edges are placed between adjacent vertices. Define a stochastic process where each edge is declared "open" with probability p and "closed" otherwise; this process is called bond percolation on Z^d. A major concern of percolation theory is to know how macroscopically "connected" the open subgraph of L^d is. Percolation theory has applications in statistical physics, flow through porous media, and phase transition theory.
Remarkably, there exists a (usually nontrivial) critical threshold p_c such that as p increases through p_c, a typical open subgraph induced by percolation suddenly jumps from being highly disconnected to highly connected. In this introductory talk we will discuss why the critical threshold is where it is in bond percolation on Z^d. We will also discuss the conjectured behavior of percolation near the critical threshold, touching on scaling and renormalization theory as time permits.

Geometric Function Theory Seminar
Wednesday, December 6, 3:10-4:00pm
4096 EH
Zair Ibragimov (UM Visiting Scholar)
Diametrically maximal sets

A bounded set M in a metric space X is called diametrically maximal if addition of a point $x\in X\setminus M$ to $M $ increases the diameter of M. In Euclidean spaces as well as in certain Banach spaces, the diametrically maximal sets are precisely the sets of constant width. (A set in a finite dimensional Banach space is said to be of constant width if the distance between support hyperplanes in any direction is constant.) A natural generalization of a diameter is n-diameter (n\geq 2) and the transfinite diameter. In this talk we will discuss maximal sets and sets of constant width with respect to 3-diameter. In particular, we discuss an analogue of the Blaschke-Lebesgue Theorem for 3-diameter as well as a construction of the Reuleaux square. The latter is an example of a noncircular sets of constant 3-diameter.

Algebraic Geometry Seminar
Wednesday, December 6, 4:10-6:00pm
3088 EH
Julianna Tymoczko (UM)
Permutation actions on the equivariant cohomology of Grassmannians: an introduction to geometric representation theory

Geometric representation theorists build representations using geometric data of algebraic varieties, for instance the cohomology or equivariant cohomology ring of a variety. Amazing consequences can follow from the correspondence between geometric properties of the variety and algebraic properties of the representation.

We'll describe one construction of permutation actions on the equivariant cohomology of Grassmannians. This construction will use GKM theory, an algebraic algorithm to construct the equivariant cohomology of suitable varieties from a combinatorial graph. We'll also describe applications, including a generalization of the Billey formula to identify the localizations of equivariant Schubert classes.

No previous exposure to equivariant cohomology will be assumed.

Financial/Actuarial Mathematics Seminar
Thursday, December 7, 3:10-4:00pm
3088 EH
Mingxin Xu (U of NC, Charlotte)
Risk measure pricing and hedging in incomplete markets

This work attempts to extend the complete market option pricing theory to incomplete markets in the direction of risk control. Instead of eliminating the risk by a perfect hedging portfolio as in complete markets, partial hedging will be adopted and some residual risk at expiration will be tolerated. In the spirit of the utility indifference principle, the risk measure (or risk indifference) prices charged for buying or selling an option are associated to the capital required for dynamic hedging so that the risk exposure will not increase. The associated optimal hedging portfolio is decided by minimizing a convex measure of risk. The general framework (definition of risk measure prices and risk-efficient options and the existence of optimal partial hedging portfolios) will be established with convex risk measures, or particularly, coherent risk measures. It will be confirmed that options evaluated by risk measure pricing rules are indeed risk-efficient. Relationships to utility indifference pricing and pricing by valuation and stress measures will be discussed. Examples using the shortfall risk measure and average Value-at-Risk will be shown.

Topology Seminar
Thursday, December 7, 3:10-4:00pm
4096 EH
Ian Leary (OSU)
Finite subgroups of VF groups

I will define what I mean by a VF group, I will explain why one might expect them to contain few conjugacy classes of finite subgroups, and I will describe a construction of VF groups having many conjugacy classes of finite subgroups. This construction answers questions of H. Bass, K. S. Brown and J.-P. Serre. Part of this is joint work with Brita Nucinkis.

Analysis Study Seminar
Thursday, December 7, 3:10-5:00pm
2866 EH
Mario Bonk (UM) Asymptotic cones (continued)

Asymptotic cones are useful in studying the large scale behavior of a metric space. The definition of this concept is based on ultrafilters and ultralimits. I will discuss the basic definitions and present some applications.

Differential Equations
Thursday, December 7, 4:10-5:00pm
4096 EH
Markus Keel (Minnesota)
Energy transfer to higher modes in a Hamiltonian nonlinear Schroedinger equation

We'll discuss joint work with J. Colliander, G. Staffilani, H. Takaoka, and T. Tao, concerning the growth of higher Sobolev norms in the 2d cubic nonlinear Schroedinger equation, with periodic boundary conditions.
The energy of our non-integrable PDE is conserved, but one can ask whether it's possible for smoother norms to grow in time. Such growth provides at least some quantitative measure of how energy might move from lower modes to arbitrarily high modes of the solution. Our result gives an example of such behavior.
The construction splits into a combinatorial argument regarding the solution's frequency support, and the demonstration of a travelling wave solution in a system of ODE's (a particular example of "diffusion") that governs the amplitudes of each mode.

Math Club
Thursday, December 7, 4:10-5:00pm
2nd Floor Nesbitt Room
Benjamin Weiss (UM)
The Generalized Factorial

In 1997 Manjul Bhargava defined a family of functions called the Generalized Factorials. In this talk we shall go over his definition and show that these functions all seem to have many of the useful properties of the normal factorial function. Recall that the normal factorial function takes a natural number n to n!, the product of the first n natural numbers. Finally, we shall present a number of unsolved problems; for example, what exactly do the generalized binomial numbers represent? Hopefully, people will leave with enough knowledge to spend their Study Days working on these unsolved problems.

Applied and Interdisciplinary Mathematics Seminar
Friday, December 8, 3:10-4:00pm
1360 EH
Emery Brown (Harvard)
Application of the State-Space Model Paradigm to Neuroscience Data Analysis

The state-space paradigm has been widely used to analyze a broad range of stochastic dynamical systems problems in engineering, computer science, statistics and the social sciences. We have used the paradigm to construct signal processing algorithms to analyze several neural systems. In this talk, we will review our work on the use of state-space modeling paradigm to study three problems in neuroscience data analysis: tracking on millisecond time-scale the dynamics of the spatial receptive fields of rat hippocampal neurons during learning; decoding how ensembles of pyramidal neurons in the rat hippocampus maintain a dynamic representation of the animal's position in its environment; and devising a dynamic solution to the source localization for magnetoencephalography.

Student Geometry/Topology
Friday, December 8, 3:10-4:00pm
3096 EH
David Constantine (UM)
The Use of the Boundary at Infinity in Rigidity Theory

A 'boundary at infinity' can be defined for non-positively curved spaces. Points on the boundary are equivalence classes of geodesics, where geodesics that stay within a bounded distance of each other as they head out to infinity are equivalent. Surprisingly (to me anyway), although this boundary appears to forget lots of information about the space, it is incredibly useful for proving all sorts of theorems. In addition, many structures we all know and love from different parts of math are used when working with the boundary at infinity - topologies, metrics, measures, quasi-conformal structures, buildings... I'll discuss some of these at a very introductory level and take a brief look at how the boundary comes into play when proving some big theorems in rigidity theory. I'll also hopefully whet our collective appetite for Felipe's talk on Mostow rigidity the following week.