Winter 2006
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
March 27th – April 2nd

Monday, March 27

3:10-4:00pm **Topics in Algebraic Geometry** ---Chuck Cadman (UM) *A primer on Orbifold Cohomology* --- 3866 EH

3:10-4:30pm **Arithmetic Number Theory Seminar**---Chandrashekar Khare (Univ. of Utah) *Serre's modularity conjecture* ---4096 EH

3:10-4:00pm **Topology Seminar** ---Hossein Namazi (Princeton) *Heegaard splittings and hyperbolic geometry* ---3096 EH

4:10-5:00pm **Group and Lie Theory Seminar**--- Marty Weissman (Berkeley) *Local L-functions in representation theory* ---4088 EH

4:10-5:00pm **Several Complex Variables Seminar**---Feng Rong (UM) *Attracters on P^k* ---3096 EH

5:15-6:30pm **Teaching Mathematics**---Vilma Mesa (UM – School of Education) *What is the Answer? Contrasting Undergraduate Calculus Textbook Content*---3088 EH

Tuesday, March 28

2:30-4:00pm **Number Theory Student Seminar**---Not meeting this week---4096 EH

3:10-4:00pm **Geometry Seminar**---Zheng Fangyang (Ohio State U) TBA---3096EH

3:10-4:00pm **Noncommutative Algebra Seminar**---Not meeting this week ---4088EH

3:10-4:00pm **Complex Analysis Seminar** ---James Tung (MSU) *Taylor coefficients of functions in Fock spaces*---3088 EH

3:10-4:00pm **Student Commutative Algebra and Algebraic Geometry**---Janis Stipins (UM) *Configurations of lines and pencils of plane curves* ---3866EH

4:10-5:00pm **Colloquium**--- Barbara Lee Keyfitz (Fields Institute/Univ of Houston) *Why are Multidimensional Conservation Laws so Difficult?*---1360 EH

5:00-6:00pm **Student Analysis Seminar**---Not meeting this week---3866 EH

5:00-6:00pm **Social Hour**---Upper Atrium

Wednesday, March 29

3:10-4:00pm **AIM Student-Run Seminar**---Andy Stein (UM) *Using PDEs and optimization techniques to better understand malignant brain cancer invasion in an in vitro experiment* ---3096 EH

3:10-4:00pm **Geometric Function Theory Seminar**--- Stephen Keith (Australia National Univ) *The Kato Square Root Problem for mixed boundary value problems*---4096 EH

4:10-5:00pm **Student Arithmetic Seminar** ---Hester Graves (UM) *(Ir)reducible polynomials* ---3866 EH

4:10-:5:00pm **Differential Equations** ---Eitan Tadmor (Univ. of Maryland) Kinetic formulations and regularizing effects in quasilinear PDEs---3096 EH

4:10-5:00pm **Colloquium (Special Seminar)**---Yuval Peres (UC Berkeley) *Point Processes, Repulsion, and Fair Allocation*---1360 EH

4:10-6:00pm **Algebraic Geometry Seminar**---Alessio Corti (Imperial College) *Quantum cohomology of Fano simplicial toric stacks* ---3088 EH

4:30-5:30pm **Theoretical Computer Science Seminar**---Not meeting this week ---3437 EECS

Thursday, March 30

3:10-4:00pm **Financial/Actuarial Mathematics Seminar---**Andrew Lim (U of C - Berkeley) *A Relative performance approach to robust portfolio selection where there is a model ambiguity***---** 3088 EH

3:10-4:00pm **Commutative Algebra Seminar**---Hailong Dao (UM) *Intersection Theory and Commutative Algebra (*continued*)* ---3096 EH

Thursday, March 30 cont.

3:10-5:00pm **Analysis Study Seminar**---Sergey Merenkov (UM) "*Removability theorems for Sobolev functions and quasiconformal maps*", *by Peter Jones and Stanislav Smirnov, Ark. Mat., 2000* ---2866 EH
4:00-5:00pm **Mathematical Biology**---Not meeting this week ---4088 EH
4:10-5:00pm **Math Club**---Martin Strauss (UM) *The P. vs. NP problem* ---2nd Floor Nesbitt Room
4:10-5:00pm **Several Complex Variables (Special Seminar)** ---Erlend Fornaess Wold (Univ. of Oslo) *Embedding Subsets of Tori properly into C^2*---3096 EH

Friday, March 31

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar**---D. Viswanath (UM) *Strange attractors from Lorenz to turbulence* ---1084 EH
3:10-4:00pm **Student Geometry/Topology**---Ryan Kinser (UM) *Introduction to Quivers*---3096 EH
4:10-5:00pm **Combinatorics**---Cristian Lenart (SUNY Albany) *Generalizing the combinatorics of Young tableax to arbitrary Lie type* ---3866 EH

EVENTS THIS WEEK:

Rackham Outstanding GSI Award Ceremony
March 27, 2006
4:00 pm
Rackham Amphitheatre

UPCOMING EVENTS:

Sumner Myers Lecture
April 4, 2006
Calin Chindris
The cone of effective weights for quivers and Horn type problems

Undergraduate Awards Ceremony
April 6, 2006
1360 EH
4:00 – 6:00pm

Distinguished University Professorship Lecture
April 11, 2006
Rackham Amphitheatre
Mel Hochster - Speaker

Spring Lecture Series
April 13-19, 2006
Paul Biran

Commencements
April 28, 2006
Upper Atrium
4:30 – 6:00pm

Geometric Function Theory in the XXI Century
May 8-12, 2006

2006-07 Rainich Lectures
October 30-November 3, 2006
Phil Holmes (Princeton University)
Schedule and talks TBA

ABSTRACTS FOR THE WEEK OF MAR. 27 – APR. 2, 2006

Arithmetic Number Theory Seminar
Monday, March 27, 3:10-4:30pm
4096 EH
Chandrashekar Khare (Univ. of Utah)
Serre's modularity conjecture

I will give an account of recent progress on the conjecture and the recent proof of the odd-level case in joint work with Wintenberger.

Topology Seminar
Monday, March 27, 3:10-4:00pm
3096 EH
Hossein Namazi (Princeton)
Heegaard splittings and hyperbolic geometry

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An outstanding problem in the study of closed 3-manifolds is the question that how the geometric structures looks like depending on the topology of the manifold. The major part of the problem is to give a concrete description of the hyperbolic metric on closed 3-manifolds by starting from a topological description. We will talk about a new approach toward this problem which uses the deformation theory of hyperbolic structures on open manifolds. We will see how this approach works for a large class of closed 3- manifolds. Furthermore in order to show the power of this geometric picture we mention how one can use it to prove many interesting topological facts about these 3-manifolds.

Group and Lie Theory Seminar
Monday, March 27, 4:10-5:00pm
4088 EH
Marty Weissman (Berkeley)
Local L-functions in representation theory

According to the local Langlands program, one should be able to associate an invariant, called the L-function, to the data of a reductive group G over a local field F, an admissible representation of G(F), and an algebraic representation of the L-group. Most of the theory of L-functions is inextricably influenced by the history of L-functions in number theory. I will try to reintroduce L-functions, some results, and some conjectures, purely in the context of representation theory.

Several Complex Variables Seminar
Monday, March 27, 4:10-5:00pm
3096 EH
Feng Rong (UM)
Attracters on P^k

We consider small pertubations of certain regular maps on P^k. We show that these maps have nonalgebraic chaotic attractors. Furthermore, we construct hyperbolic measures on the attractors, which are mixing and of maximal entropy. Finally, we mention some results of T.C.Dinh on attracting currents.

Teaching Mathematics
Monday, March 27, 5:15 – 6:30pm
3088 EH
Vilma Mesa (UM – School of Education)
What is the Answer? Contrasting Undergraduate Calculus Textbook Content

In this presentation I want to discuss preliminary results of an analysis of introductory calculus textbooks that looks at strategies available to students for (1) determining whether an action was relevant when solving a problem and (2) deciding that the problem was solved. This is known as the control structure (Balacheff, 2005). The books chosen differ in terms of audience (Honors, Regular, Applied) and in terms of degree of influence by the calculus reform movement. The study describes the control strategies that are present in lessons and examples associated with the notion of derivative and establishes differences across textbooks. Sociological and hermeneutic lenses are being used to analyze the texts. There are two main hypotheses in this study: (1) Control strategies tend to rely more on content at stake in books intended for honors students, and (2) Reform oriented textbooks provide the control structure more explicitly. Next steps will be discussed.
Reference : Balacheff, N. (2005). "Conception, propriete du systeme sujet/milieu" [Conception: A property of the learner-milieu system]. In Noirfalise R., Perrin-Glorian M.-J. (Eds.) Actes de la VIIo Ecole d'ete de didactique des mathematiques (pp.215-229). Clermont-Ferrand: IREM de Clermont-Ferrand.

Student Commutative Algebra and Algebraic Geometry
Tuesday, March 28, 3:10- 4:00pm
3866 EH
Janis Stipins (UM)
Configurations of lines and pencils of plane curves

I will give examples of some famous configurations of lines, and present Hirzebruch's beautiful result (without proof) that gives a sharp combinatorial inequality necessary for the existence of configurations in the complex projective plane. In addition, I will discuss some related topics involving pencils of plane curves.

Complex Analysis Seminar
Tuesday, March 28, 3:10-4:00pm
3088 EH
James Tung (MSU)
Taylor coefficients of functions in Fock spaces

For analytic functions on the unit disk, the classical Hausdorff--Young and Hardy--Littlewood theorems describe necessary or sufficient conditions for the functions to belong to Hardy spaces. The conditions are in terms of the Taylor coefficients of the functions. We will show that there are analogous conditions for entire functions to belong to Fock spaces, and that these conditions can be improved in certain senses.

Colloquium
Tuesday, March 28, 4:10-5:00pm
1360 EH
Barbara Lee Keyfitz (Fields Institute/Univ. of Houston)
Why are Multidimensional Conservation Laws so Difficult?

An outstanding open problem in the theory of partial differential equations is the well-posedness of initial-value problems for nonlinear hyperbolic equations in more than one space dimension. This talk will set a context for problems for nonlinear hyperbolic equations in more than one space dimension. This talk will set a context for the problem: Why are mathematicians interested in partial differential equations, what are the differences between the way pure and applied mathematicians approach the subject, and how can different approaches reinforce each other?
The talk is intended for an audience which is not expert in partial differential equations, and will begin by explaining why the division of equations into "hyperbolic" and "elliptic" is natural mathematically as well as being grounded in applications. We will describe briefly the analysis used to prove existence theorems for linear equations of both types.
Generalizing the elliptic theory to quasilinear and nonlinear elliptic equations has been largely achieved, but the corresponding theory for hyperbolic equations is still being developed. Some simple examples serve to show the sorts of obstructions we may expect. A number of routes through these challenges seem ready to be explored. Finally, I will describe a new approach that I, along with co-workers and others, are pursuing, which exploits the better-developed theory of quasilinear elliptic equations to study multidimensional quasilinear hyperbolic equations.

AIM Student-Run Seminar
Wednesday, March 29, 3:10-4:00pm
3096 EH
Using PDEs and optimization techniques to better understand malignant brain cancer invasion in an in vitro experiment

Malignant brain cancer is a terrible disease, usually killing people within a year of diagnosis. There are tons of doctors and biologists studying this problem, but they're not making much progress and they've been getting desperate. So, of course, they've turned to mathematicians for help.

At this talk, I will present a simple PDE model for describing the growth of two different types of brain tumor spheroids in a collagen-I gel (a.k.a. jello). Using an optimization routine to find the parameters that best fit the data, we can better understand how these
two cell lines behave differently from each other. The results
indicate that one cell line is stickier and moves in a less directed fashion than the other, and this is neat because no one knew this, before.

Geometric Function Theory Seminar
Wednesday, March 29, 3:10-4:00pm
4096 EH
Stephen Keith (Australia National Univ)
The Kato Square Root Problem for mixed boundary value problems

We solve the Kato square root problem for second order elliptic systems in divergence form under mixed boundary conditions on Lipschitz domains. This answers a question posed by J.-L. Lions in 1962. To do this we develop a general theory of quadratic estimates and functional calculi for complex perturbations of Dirac-type operators on Lipschitz domains.

Differential Equations Seminar
Wednesday, March 29, 4:10-5:00pm
3096 EH
Eitan Tadmor (U of Maryland)
Kinetic formulations and regularizing effects in quasilinear PDEs

We study the regularizing effects in quasilinear equations L(U, d_x)U=S(U) using velocity averaging of their underlying kinetic formulations. To this end, we quantify the regularizing effect of velocity averaging for all L's of degree \leq 2, involving nonlinear transport velocity and degenerate diffusion. In particular, we improve previous regularity statements for multidimensional conservation laws, and we derive completely new regularity results for related nonlinear convection-diffusion and elliptic equations driven by degenerate, non-isotropic diffusion.

Colloquium (Special Seminar)
Wednesday, March 29, 4:10-5:00pm
1360 EH
Yuval Peres (UC Berkeley)
Point Processes, Repulsion, and Fair Allocation

A random collection of points in space is called a "point process". The simplest point process is the Poisson process, where the numbers of points in disjoint regions are independent. Recently, there has been increasing interest in processes that exhibit "repulsion", such as zeros of random polynomials, noncolliding particles and eigenvalues of random matrices. I will describe the class of determinantal point processes, which exhibit perfect repulsion, and discuss the dynamical meaning of repulsion.
(For illustration see the movie at http://stat-www.berkeley.edu/~peres/GAF/dynamics/dynamics.html).
In the second part of the talk I will discuss the problem of "fair allocation": allocating the same area to every point of an isometry-invariant point process. Given such a point process M in the plane, the Voronoi tesselation assigns a polygon (of different area) to each point of M. The geometry of fair allocations is much richer: For any Isometry-invariant point process, we show that there is a unique fair allocation that is "stable" in the sense of the Gale-Shapley stable marriage problem. It turns out that repelling point processes have allocations that are better localized than the Poisson process. In higher dimensions, it appears that "gravitational allocation" does better than "market forces".
(For more details see http://stat-www.berkeley.edu/~peres/stable/stable.html).

Financial/Actuarial Mathematics Seminar
Thursday, March 30, 3:10-4:00pm
3088 EH
Andrew Lim (U of C - Berkeley)
A Relative performance approach to robust portfolio selection when there is model ambiguity

Recent interest in the topic of ``investment with model ambiguity'' in the finance, economics and decision theory communities has been motivated largely by efforts to incorporate ``ambiguity aversion'', as suggested by experiments such as the Ellsberg Paradox, in the analysis of agent behavior. Closely related work on ``robust portfolio selection'' in the optimization community has been driven by the observation that the solutions of classical optimal portfolio selection problems (such as ``mean-variance optimization'') are sensitive to statistical errors that can arise during calibration, and that the ``real world'' performance of such portfolios can be poor if these errors are ignored. The commonly used method for addressing these issues is some sort of ``worst case'' optimization which has led in turn to methodologies such as ``worst case mean-variance'' and ``worst case utility maximization''. While the ``worst case approach'' has its axiomatic foundations in the work of Gilboa and Schmeidler, it has also been criticized for being ``overly pessimistic''.

In this talk, we propose and analyze an alternative measure of` ``robust performance''. This alternative measure differs from the typical ``worst case expected utility'' and ``worst case mean-variance'' formulations in that the ``robust performance'' of a (dynamic) portfolio is evaluated not only on the basis of its performance when there is an adversarial opponent
(``nature''), but also by its performance relative to a fully informed ``benchmark investor'' who behaves optimally given complete knowledge of the otherwise ambiguous model. This ``relative performance'' approach has several important properties: (i) decisions arising from this approach are less pessimistic than the portfolios obtained from the typical ``worst case expected utility'' and ``worst case mean-variance'' formulations, (ii) the dynamic ``relative performance'' problem reduces to a convex static optimization problem under reasonable choices of the benchmark portfolio, and (iii) the solution of the ``relative performance'' problem coincides with that of a ``Bayesian'' portfolio choice problem with an appropriately chosen prior. The static problem is interesting in its own right: it can be interpreted as a less pessimistic alternative to the single period ``worst case mean-variance'' problem.
Joint work with J. George Shanthikumar and Thaisiri Watewai

Commutative Algebra Seminar
Thursday, March 30, 3:10-4:00pm
3096 EH
Hailong Dao (UM)
***Intersection Theory and Commutative Algebra* (continued)**

This is a series of talks to supplement Mel Hochster's recent lectures on Homological Conjectures. We will discuss how results and ideas from intersection theory, especially in projective spaces, help resolve some questions among the homological conjectures and clarify others. The material comes from recent works by Kurano, Roberts and Srinivas. If time permits, we may discuss yet more applications to homological questions such as height stability or rigidity of Tor.

Analysis Study Seminar
Thursday, March 30, 3:00-5:00pm
2866 EH
Sergey Merenkov (UM)
"Removability theorems for Sobolev functions and quasiconformal maps", by Peter Jones and StanislavSmirnov, Ark. Mat., 2000

From the abstract: "We establish several conditions, sufficient for a set to be (quasi)conformally removable... This is accomplished by proving removability theorems for Sobolev spaces..."

Math Club
Thursday, March 30, 4:10-5:00pm
2nd Floor Nesbitt Room
Martin Strauss (UM)
The P. vs NP problem

Given a graph and a cycle through the graph, it is easy to check whether the cycle visits each vertex exactly once. But how easy is it to find such a cycle if it exists? In general, given a combinatorial problem whose solutions can be checked quickly by computer, can the solutions also be found quickly by computer? In a nutshell, this is the P. vs. NP question. It is an important question because combinatorial problems arise frequently. We discuss this and related questions regarding the nature of efficient computation.

Several Complex Variables (Special Seminar)
Thursday, March 30, 4:10-5:00pm
3096 EH
Erlend Fornaess Wold (Univ. of Oslo)
Embedding Subsets of Tori properly into C^2

We will talk about the problem of embedding (open) Riemann surfaces properly into C^2. Specifically, we will present the following result: Let R be a compact Riemann surface of genus 1, and let U be a domain in R such that R\U consists of a finite number of connected components, none of them being points. Then U embeds properly into C^2.

Applied and Interdisciplinary Mathematics Seminar
Friday, March 31, 2006, 3:10-4:00pm
1084 EH
D. Viswanath (UM)
Strange attractors from Lorenz to turbulence

While direct numerical simulation helps us understand the statistics of turbulent fluid flows, understanding the geometry of turbulent flows in phase space requires the computation of steady states, traveling waves, periodic motions, and close recurrences. In plane Couette flow, two parallel walls move in opposite directions and drive the fluid in-between. Turbulence results if the walls drive the fluid too hard and the Reynolds number is high enough. This talk will describe accurate and well resolved computations of 3-dimensional traveling periodic solutions within plane Couette turbulence. The computed solutions and analogy to the Lorenz equations will be used as a basis to discuss the manner in which the geometry of turbulent dynamics in phase space can be understood.

Combinatorics
Friday, March 31, 4:10-5:00pm
3866EH
Cristian Lenart
Generalizing the combinatorics of Young tableax to arbitrary Lie type

Young tableaux provide a combinatorial model for the irreducible characters of the Lie algebra of type A. A simple combinatorial model for the irreducible characters of an arbitrary semisimple Lie algebra (and, more generally, of a symmetrizable Kac-Moody algebra) was recently developed in joint work with A. Postnikov. This model is based on the combinatorics of the corresponding Weyl group and, in the finite case, of the affine Weyl group, and it leads to an extensive generalization of the combinatorics of Young tableaux. In this talk, we present recent results in this direction. We use the setup of crystal graphs, which are colored directed graphs on the canonical basis of a representation. In this context, we present an explicit combinatorial description (generalizing Schützenberger's "evacuation" procedure for tableaux) of the involution which realizes the crystals as self-dual posets. We also discuss combinatorial aspects related to the product of crystals. The talk will be largely self-contained.