Fall 2008
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
November 17th – November 23rd

Monday, November 17

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** --- Tasho Statev Kaletha (Chicago) *Towards a stable topological trace formula* --- 4096 EH
4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- Henry de Thelin (University Paris 11, France) *Dynamics of meromorphic maps on compact Kahler manifolds* --- 3096 EH
4:10-5:00pm **Student Combinatorics** --- Jiarui Fei (UM) *Quiver representations and cluster algebras* --- 3866 EH
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3096 EH

Tuesday, November 18

2:10-3:00pm "**What is … " Seminar** --- Not meeting this week --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Hugo Parlier (EPFL) *Ber's constant for punctured spheres and hyperelliptic surfaces* --- 4096 EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH
4:10-5:00pm **Ziwet Lectures I (Colloquium)** --- Ioannis Karatzas (U of Columbia) *Some Stochastic Control Problems in Mathematical Finance* --- 1360 EH
4:10-5:00pm **Student AIM Seminar** --- TBA --- 3088 EH

Wednesday, November 19

3:10-4:00pm **Ziwet Lectures II** --- Ioannis Karatzas (U of Columbia) *Volatility Stabilization, Diversity and Arbitrage* --- 1518 C. C. Little Building
3:10-4:00pm **Geometric Function Theory Seminar** --- Yurii Lyubarskii (Norwegian University of Science and Technology) *Gabor frames and complex interpolation* --- 4096 EH
3:10-4:00pm **Student Representation Theory Seminar** --- Brian Jurgelewicz (UM) TBA --- 3096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- Leo Goldmakher (UM) *Large character sums and the Polya-Vinogradov inequality* --- 3866 EH
4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Elizabeth Wulcan (UM) *The membership problem for polynomial ideals via residue currents* --- 3096 EH
4:10-6:00pm **Algebra Seminar (Special)** --- John Duncan (Harvard*) Vertex algebra and sporadic simple groups* --- 3088 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Not meeting this week --- 3088 EH

Thursday, November 20

1:10-2:00pm **Ziwet Lectures III** --- Ioannis Karatzas (U of Columbia) *Optimal Arbitrage* --- 1096 EH
2:10-3:00pm **Commutative Algebra Seminar (Special Time)** --- TBA --- 3096 EH
3:10-4:00pm **Algebra Seminar (Special)** --- John Duncan (Harvard) *Rademacher sums and Monstrous Moonshine* --- 3096 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- TBA --- 3088 EH
3:10-4:00pm **Topology Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Differential Equations** --- Irina Nenciu (UIC) *On confining potentials and essential self-adjointness for Schroedinger operators on bounded domains* --- 4088 EH
4:10-5:00pm **Math Club** --- Crystal Zeager (UM) *The Most Famous Pictures in Math* --- 2nd floor Nesbitt Common Room
4:10-5:00pm **Reading Group in Probabilistic Methods in Geometric Functional Analysis and Combinatorics** --- 3096 EH

Thursday, November 20 … cont.

4:10-6:00pm **RTG Study Seminar** --- Not meeting this week --- 3866 EH
4:10-6:00pm **Geometry and Physics Seminar** --- Todor Milanov (North Carolina State) *$\mathcal{W}_{N+1}$-constraints for Singularities of Type A_N* --- 4096 EH

Friday, November 21

11:10-12:00pm **Theoretical Computer Science Seminar** --- TBA --- CSE 3941
3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Selim Esedoglu (UM) *New Algorithms for Multi-phase Flow and High Order Geometric Motions* --- 1084 EH
3:10-4:00pm **Student Geometry/Topology** --- Ben Fehrman (UM) *Morse Theory* --- 3096 EH
4:10-5:00pm **Combinatorics** --- Drew Armstrong (U Minnesota) *Noncrossing and nonnesting in finite Coxeter groups* --- 3866 EH

EVENTS THIS WEEK

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.

EVENTS THIS WEEK … 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
Some Stochastic Control Problems in Mathematical Finance

We formulate and review a class of stochastic control problems, collectively known under the rubric of "portfolio optimization", that arise in the mathematics of finance. Ideas from convex duality play a prominent role in the resolution of these problems; so does the theory of parabolic partial differential equations, under certain strong conditions on the financial market structure. Under less stringent conditions, stochastic analogues of the classical Hamilton-Jacobi-Bellman equation emerge as particularly relevant in this context, in connection with ideas and results from 'backwards' stochastic equations and the Ito-Wentzell formula for random fields. Using such tools, feedback formulae become available for the investor's optimal strategies, based on his current level of wealth. Recent progress on these issues will be surveyed, and some open questions will be mentioned.

Ziwet Lectures II
Wednesday, November 19, 3:10-4:00pm
1518 C.C. Little Building
Volatility Stabilization, Diversity and Arbitrage

We start with a survey of the modern theory of portfolios, based on Stochastic Analysis. We introduce the notion of relative arbitrage and provide simple, easy-to-test criteria for the existence of such arbitrage in equity markets. These criteria postulate essentially that the excess growth rate of the market portfolio, a positive quantity which can be estimated or even computed from a given market structure, and which measures the market's "intrinsic volatility" in a sense to be made precise, be "sufficiently large". We show that conditions satisfying these criteria are manifestly present in the US equity market, and construct explicit portfolios that can out-perform the market under these conditions. One such condition, market diversity, emerges when the volatility structure is bounded. We then construct examples of abstract markets in which the criteria hold. We study in some detail a specific example of a non-diverse abstract market which is volatility-stabilized, in that the return from the market portfolio has constant drift and variance rates, while the smallest stocks are assigned the largest volatilities and individual stocks fluctuate widely. A rather interesting probabilistic structure emerges in which time changes, Bessel processes, and the asymptotic theory for planar Brownian motion, play crucial roles.

Ziwet Lectures III
Thursday, November 20, 1:10-2:00pm
1096 EH
Optimal Arbitrage

If there is arbitrage relative to the market, how does one construct the "best" such arbitrage? We formulate this question in a precise manner, and provide some results in a fairly general framework using H. Foellmer's "exit measure" for an appropriate supermartingale. We then specialize to a Markovian framework. Here, we are able to characterize this "best" arbitrage: first in terms of the smallest positive solution to a parabolic partial differential inequality, determined entirely on the basis of the covariance structure of the model; and then in terms of the probability that an auxiliary multidimensional diffusion hits the boundary of the positive orthant.

ABSTRACTS FOR THE WEEK OF NOV. 17 – NOV. 23, 2008

Group Theory/Lie Theory/Number Theory Seminar
Monday, November 17, 3:10-5:00pm
4096 EH
Tasho Statev Kaletha (Chicago)
Towards a stable topological trace formula

The topological trace formula of Goresky and MacPherson is an important tool in the study of the cohomology of arithmetic groups and the theory of Shimura varieties. It expresses the trace of a Hecke operator in terms of geometric data on a given reductive group. Just as in the case of Arthur's trace formula, many applications of the topological trace formula require that it be stabilized – a process involving the theory of endoscopy, as developed by Langlands, Shelstad and Kottwitz. In this talk we will introduce the topological trace formula and the theory of endoscopy and will then discuss current work on the stabilization of the topological trace formula.

Several Complex Variables and Complex Dynamics Seminar
Monday, November 17, 4:10-5:00pm
3096 EH
Henry de Thelin (University Paris 11, France)
Dynamics of meromorphic maps on compact Kahler manifolds

We study the dynamics of a meromorphic map on a compact Kahler manifold. We give a criterion that allows us to produce a measure of maximal entropy and we apply this criterion for a family of generic birational maps of CP^k. This is a joint work with Gabriel Vigny.

Student Combinatorics
Monday, November 17, 4:10-5:00pm
3866 EH
Jiarui Fei (UM)
Quiver representations and cluster algebras

In this talk, I will explain how the representation theory of quivers is related to cluster algebras. We can work out a lot of examples together. It will be elementary and fun.

Geometry Seminar
Tuesday, November 18, 3:10-4:00pm
4096 EH
Hugo Parlier (EPFL)
Ber's constant for punctured spheres and hyperelliptic surfaces

Lipman Bers showed that one can cut a finite area hyperbolic surface along disjoint ``short'' curves so that the result is a set of three holed spheres. Here the term ``short'' means that the length of each curve is bounded by a constant (Bers' constant) which only depends on the topology of the surface and not on the metric. The best bounds (upper and lower) on Bers' constant are due to Peter Buser who also conjectured the existence of a universal constant C such that Bers' constant is bounded above by C times the square root of the area (which is linear in the Euler characteristic). The goal of the talk will be to present a solution to the conjecture for punctured spheres and hyperelliptic surfaces. This is joint work with Florent Balacheff.

Geometric Function Theory Seminar
Wednesday, November 19, 3:10-4:00pm
4096 EH
Yurii Lyubarskii (Norwegian University of Science and Technology)
Gabor frames and complex interpolation

The Gabor frames machinery is now one of the most popular tools in time-frequency analysis. We will discuss the basic notions and facts related to Gabor frames and also their connection to interpolation problems in spaces of entire functions.
This is a joint work with Karlheinz Groechenig (University of Vienna)

Student Arithmetic Seminar
Wednesday, November 19, 3:10-4:00pm
3866 EH
Leo Goldmakher (UM)
Large character sums and the Polya-Vinogradov inequality

Because of their close connection with L-functions, character sums have become one of the central objects of study in analytic number theory. In 1918, Polya and Vinogradov independently proved an upper bound on character sums which is non-trivial for N > q^{1/2 + \epsilon}, where N is the number of terms in the sum and q is the conductor. Despite some significant progress since then on shorter character sums, the Polya-Vinogradov inequality remains the strongest result in the full range N < q. Quite recently, Granville and Soundararajan broke this barrier for the first time in nearly 90 years, by showing that for characters of odd order one can improve Polya-Vinogradov. I'll talk about their work, as well as my recent results improving Polya-Vinogradov for characters whose conductor is smooth (i.e. has only small prime factors).

RTG Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, November 19, 4:10-5:00pm
3096 EH
Elizabeth Wulcan (UM)
The membership problem for polynomial ideals via residue currents

I will discuss how residue currents can be used to obtain effective versions of Hilbert's Nullstellensatz. The talk will be based on work by Andersson and Andersson-G\"otmark.

Algebra Seminar (Special)
Wednesday, November 19, 4:10-6:00pm
3088 EH
John Duncan (Harvard*)*
Vertex algebra and sporadic simple groups

The Classification of the Finite Simple Groups constitutes one of the greatest mathematical acheivements of the 20th century. One of the most surprising features of The Classification is the appearance of the sporadic simple groups: those finitely many finite simple groups that do not arise as a member of one of the natural infinite families.

Many interesting techniques have been developed for the purpose of studying one or other of the sporadic simple groups. Very notably, the largest sporadic simple group --- the Fischer--Griess Monster --- was constructed by Griess as the automorphism group of a certain non-associative algebra in the early 1980's. This construction was an important catalyst for the development of the theory of vertex algebra, which has played an extremely important role in subsequent research on the Monster group, and in many other fields as well.

Vertex algebra is a unifying force in mathematics. We will illustrate a special case of this by outlining our program to provide a uniform treatment of the sporadic simple groups via vertex algebraic methods. Recent progress includes constructions of sporadic groups that are not involved in the Monster, and ellucidation of the consequent connections with infinite dimensional Lie algebras and modular functions.

Differential Equations
Thursday, November 20, 4:10-5:00pm
4088 EH
Irina Nenciu (UIC)
On confining potentials and essential self-adjointness for Schroedinger operators on bounded domains

On confining potentials and essential self-adjointness for Schroedinger operators on bounded domains --- Let $\Om$ be a bounded domain in $\IR^n$ with C^2-smooth boundary, $\partial\Om$, of co-dimension 1, and let $H=-\Delta +V(x)$ be a Schr\"odinger operator on $\Om$ with potential $V \in L^{\infty}_{loc}(\Om)$. We seek the weakest conditions we can find on the rate of growth of the potential V close to the boundary $\partial\Om$ which guarantee essential self-adjointness of H on $C_0^\infty(\Om)$. As a special case of an abstract condition, we add optimal logarithmic type corrections to the known condition $V(x)\geq \frac{3}{4d(x)^2}$ where $d(x)=\text{dist}(x,\partial\Om)$. More precisely, we show that if, as x approaches $\partial\Om$, $$ V(x)\geq \frac{1}{d(x)^2}\biggl(\frac34-\frac{1}{\ln(d(x)^{-1})}- \frac{1}{\ln(d(x)^{-1})\cdot\ln\ln(d(x)^{-1})}-\cdots\biggr) $$ where the brackets contain an arbitrary finite number of logarithmic terms, then H is essentially self-adjoint on $C_0^\infty(\Om)$. The constant 1 in front of each logarithmic term is optimal. The proof is based on a refined exponential Agmon estimate combined with a well known multidimensional Hardy inequality.

Math Club
Thursday, November 20, 4:10-5:00pm
2nd floor Nesbitt Common Room
Crystal Zeager (UM)
The Most Famous Pictures in Math

Fractals are well known in popular culture, but it is not clear how they came out of math. In fact, they encode information about functions. I will begin by presenting a few examples mathematically. Then I will explain how the Mandelbrot set and other fractals arise. Finally, I will state some applications to number theory and physics.

Geometry and Physics Seminar
Thursday, November 20, 4:10-6:00pm
4096 EH
Todor Milanov (North Carolina State)
$\mathcal{W}_{N+1}$-constraints for Singularities of Type A_N

In this talk I am planning to describe an approach whose goal is to characterize Gromov—Witten invariants via differential operators constraints similar to the Virasoro constraints. The idea will be explained in the case of A_N singularity, although the same methods would work for D and E_8-singularities. Using Picard-Lefschetz periods for the singularity of type A_N, we construct a projective representation of the algebra of differential operators on the circle with central charge $h := N +1.$ We prove that the total descendant potential $\mathcal{D}_{A_N}$ of A_N-singularity is a highest weight vector. It is known that $\mathcal{D}_{A_N}$ can be interpreted as a generating function of a certain class of intersection numbers on the moduli space of h-spin curves. In this settings our constraints provide a complete set of recursion relations between the intersection numbers. This work is a collaboration with B. Bakalov. Our methods are based entirely on the symplectic loop space formalism of A. Givental and thus I am expecting that they can be applied successfully to the mirror models of symplectic manifolds.

Applied and Interdisciplinary Mathematics Seminar
Friday, November 21, 3:10-4:00pm
1084 EH
Selim Esedoglu (UM)
New Algorithms for Multi-phase Flow and High Order Geometric Motions

Threshold dynamics, also called diffusion generated motion, of Merriman, Bence, and Osher generates the motion by mean curvature of an interface by alternating two very simple and computationally efficient operations: Convolution and thresholding. I will describe new variants that generate high order geometric motions (such as motion by surface diffusion) and how to improve the accuracy of the method on uniform grids. Applications include problems such as inpainting from image processing and the simulation of grain boundary motion in polycrystalline materials with many grains. The talk is based on joint works with Steve Ruuth and Richard Tsai and, separately, Matt Elsey and Peter Smereka. Emphasis will be on grain boundary motion simulations in 2D and 3D with large number of grains (joint with Elsey and Smereka).

Student Geometry/Topology
Friday, November 21, 3:10-4:00pm
3096 EH
Ben Fehrman (UM)
Morse Theory

The tools of Morse theory provide an extraordinary insight into the global topology of smooth manifolds. After developing the theory, we will observe almost as afterthoughts that every smooth manifold has the homotopy type of a CW-complex. And, that the summed indices of a vector field with isolated zeros is necessarily the manifold's Euler-characteristic. This talk will emphasize the foundations of finite-dimensional Morse theory. That is, given a manifold and a generic smooth function we will determine the manifold's topology through a simple analysis of the function's critical points. The development is concrete. To emphasize this we will show that a manifold admitting a generic smooth function with exactly two critical points is necessarily homeomorphic to the sphere. Time-permitting, applications of these ideas to certain infinite-dimensional spaces or to the development of homology theories will be mentioned if only briefly.

Combinatorics
Friday, November 21, 4:10-5:00pm
3866 EH
Drew Armstrong (U. Minnesota)
Noncrossing and nonnesting in finite Coxeter groups

There are beautiful algebraic generalizations of the poset of nonnesting partitions and the lattice of noncrossing partitions to all (crystallographic, at least) finite Coxeter groups. Both are counted by a generalized Coxeter-Catalan number and they share very refined enumerative features, yet it has been an open problem to provide any uniform bijection between these objects. In this talk I will explain the depth of this mystery and describe a conjectured uniform bijection. This is joint work with Hugh Thomas.