

Winter 2007
University of Michigan-Department of Mathematics
<http://www.math.lsa.umich.edu/seminars/index.shtml>
Ann Arbor, MI 48109-1043
March 12th – March 18th

Monday, March 12

- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Not meeting this week --- 3866 EH
3:10-4:30pm **Arithmetic/Number Theory Seminar** --- Wentang Kuo (U. Waterloo) *On the Erdős-Pomerance conjecture for the Carlitz module* --- 4096 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Anne-Katrin Herbig (UM) *Plurisubharmonic defining functions* --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- Siye Wu (Hong Kong Univ) *Geometric Langlands and quantum field theory II* --- 3088 EH
4:10-6:00pm **Group Theory/Lie Theory Seminar** --- Freydoon Shahidi (Purdue) *Some Applications of Orthogonal and Symplectic Representations of $GL(n)$* --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Alejandro Uribe (UM) *UM's mathematics courses for elementary teaching certificate candidates: My experiences with 497* --- 4096 EH

Tuesday, March 13

- 12:10-1:00pm **Student Algebraic Geometry Seminar** --- Jose Gonzalez (UM) *Toric Varieties and Polyhedra* --- 3088 EH
2:10-3:00pm **"What is ... ?" Seminar** --- Robert Krasny (UM) *What is ... a vortex sheet?* --- 3096 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar (Special Time/Room)** --- Joseph Marker (Ball State U) *Student Experience Developing Models using "Real" Data* --- 2866 EH
3:10-4:00pm **Geometry Seminar** --- Dave Constantine (UM) *Rank Rigidity via Ergodic 2-Frame Flow* --- 4088 EH
3:10-4:00pm **Algebra Seminar** --- Jason Bell (Simon Fraser U) *Subfields of division algebras* --- 3096 EH
4:10-5:00pm **Colloquium** --- Gregory Margulis (Yale) *Polynomial divergence, unipotent flows, and effective ergodic theorems* --- 1360 EH

Wednesday, March 14

- 3:10-4:00pm **Student Arithmetic Seminar** --- Not meeting this week --- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- Khachik Sargsyan (UM) *Mean First Passage Times and their Asymptotics in Markov Jump Processes* --- 3088 EH
3:10-4:00pm **Geometric Function Theory Seminar** --- Kai Rajala (U of Jyväskylä/UM Visiting Scholar) *Covering theorems for mappings of bounded and finite distortion* --- 4096 EH
4:10-5:00pm **AIM Seminar (Special Seminar)** --- Stanley J. Osher (UCLA) *New and ultra fast methods for PDE based image processing* --- 3096 EH
4:30-5:30pm **Student Analysis Seminar** --- Jasun (UM) *Fractals and Function Theory* --- 3866 EH
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Not meeting this week --- 4088 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Arend Bayer (U of Utah) *r -th root construction, weighted stable maps and orbifold quantum cohomology* --- 3088 EH

Thursday, March 15

- 3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Lech's conjecture in dimension 2* --- 3096 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Volodymyr Babich (UM) *Dealing with Supplier Bankruptcy: the Costs and Benefits of Financial Subsidies* --- 3088 EH

Thursday, March 15continued

- 3:10-4:00pm **Topology Seminar** --- Not meeting this week --- 4096 EH
3:10-5:00pm **Study Seminar** --- Mario Bonk (UM) *Manifolds that are homeomorphic, but not diffeomorphic VII* --- 2866 EH
4:10-5:00pm **Differential Equations** --- Saleh Tanveer (OSU) *Divergent Series, Borel Summation and 3-D Navier-Stokes Equation* --- 4096 EH
4:10-5:00pm **Math Club** --- Danny Forger (UM) *Optimal Oscillations (How to Avoid Jet Lag)* --- 2nd Floor Nesbitt Room
4:10-5:30pm **Logic Seminar** --- Not meeting this week --- 3096 EH
4:10-6:00pm **Geometry & Physics (Special Seminar)** --- Kevin Costelo (Northwestern) *An algebraic characterization of Segal's category of moduli spaces* --- 4088 EH
4:30-5:30pm **Theoretical Computer Science Seminar** --- Xuan Zheng (UM) *Private Approximation of Search Problems* --- CSE 3941
5:10-6:00pm **Student Combinatorics** --- Not meeting this week --- 3866 EH

Friday, March 16

- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Leonard Sander (UM) *Fluctuations Favor Fast Dispersal in Population Dynamics* ---1084 EH
3:10-4:00pm **Student Geometry/Topology** --- Not meeting this week --- 3096 EH
3:10-4:30pm **Birational Geometry Reading Seminar** --- *Reading seminar on the paper of Birkar, Cascini, Hacon and McKernan on the finite generation of the canonical ring* --- 3088 EH
4:10-5:00pm **Combinatorics** --- Not meeting this week --- 3866 EH

ABSTRACTS FOR THE WEEK OF MAR. 12 – MAR. 18, 2007

**Group Theory/Lie Theory Seminar
Monday, March 12, 4:10-6:00pm
4088 EH**

Freydoon Shahidi (Purdue)

Some Applications of Orthogonal and Symplectic Representations of $GL(n)$

Self-dual representations of $GL(n)$ are determined by means of representation theory of quasplit classical groups through functoriality, both locally and globally. In this talk we explain these concepts and apply them to two problems. First, we determine the reducibility of induced representations from maximal parabolics of classical groups over local fields in terms of this functoriality. Next, we explain the recent work of Khare-Larsen-Savin on the inverse Galois problem which relies heavily on this functoriality and the local and global symplectic representations.

Arithmetic/Number Theory Seminar
Monday, March 12, 3:10-4:30pm
4096 EH
Wentang Kuo (U. Waterloo)
On the Erdős-Pomerance conjecture for the Carlitz module

There are many sequences with integral values arisen naturally from number theory. The goal in this talk is to study their probabilistic properties. For example, for $a \in \mathbb{Z}$, $m \in \mathbb{N}$ with $(a, m) = 1$, let $l_a(m)$ be the order of a in $(\mathbb{Z}/m\mathbb{Z})^*$. Let $\omega(l_a(m))$ be the number of distinct prime divisors of $l_a(m)$. A conjecture of Erdős and Pomerance states that if $|a| > 1$, then the quantity

$$\frac{\omega(l_a(m)) - \frac{1}{2}(\log \log m)^2}{\frac{1}{\sqrt{3}}(\log \log m)^{3/2}}$$

distributes normally. The problem remains open until today. A conditional proof of it was obtained recently by Murty and Saidak, and later Li and Pomerance provided an alternative proof. In this talk, we formulate an analogous question for the Carlitz module and provide an unconditional proof of it. Also, we will discuss other analogues of this problem. It is a joint work with Y.-R. Liu

Several Complex Variables Seminar
Monday, March 12, 4:10-5:00pm
3096 EH
Anne-Katrin Herbig (UM)
Plurisubharmonic defining functions

Let D be a smoothly bounded domain in \mathbb{C}^2 . Suppose D admits a smooth defining function which is plurisubharmonic on the boundary of D . We show that the Diederich-Fornaess exponent can be chosen arbitrarily close to 1, and that the closure of D admits a Stein neighborhood basis. This work in progress for $n \geq 3$. This is joint work with J.E. Fornaess.

“What is ... ?” Seminar
Tuesday, March 13, 2:10-3:00pm
3096 EH
Robert Krasny (UM)
What is ... a vortex sheet?

A vortex sheet is a model for the interface between two streams of fluid moving at different speeds. A common example is the vortex wake behind an aircraft, which is responsible for the lift, and which poses a hazard for other aircraft in crowded airports.

The initial value problem for vortex sheets is ill-posed and a curvature singularity forms in finite time from analytic initial data, but this is just the beginning of the story. I'll describe some relevant experiments and analysis, and focus on how computations are being used to investigate the sheet dynamics. Principal value integrals appear early on and chaos enters midway.

Financial/Actuarial Mathematics Seminar (Special Time/Room)
Tuesday, March 13, 3:10-4:00pm
2866 EH
Joseph Marker (Ball State U)
Student Experience Developing Models using "Real" Data

Graduate Actuarial Science students at Ball State are applying Actuarial models to a large dataset of detailed insurance claim data. The talk will emphasize how the modeling meets the needs of an insurance business by applying actuarial science. The speaker will highlight the students' and Ball State's experience in tackling such a large project. The speaker is leading this project as Visiting Distinguished Professor of Actuarial Science at Ball State for the academic year 2006-2007. The speaker has 33 years experience in insurance companies and as founder of an actuarial consulting firm.

Geometry Seminar
Tuesday, March 13, 3:10-4:00pm
4088 EH
Dave Constantine (UM)
Rank Rigidity via Ergodic 2-Frame Flow

The rank rigidity theorem of Ballmann and Burns-Spatzier states that a non-positively curved space with higher rank is locally symmetric. Analogous notions of higher rank in strict negative and positive curvature have been developed and similar theorems proven in those curvature settings. In this talk I'll present a recent result in this vein for negatively curved spaces, namely if a compact, negatively curved manifold has what's called higher hyperbolic rank then (subject to a curvature pinching condition in even dimension) it has constant curvature. This provides a new proof of Hammenstadt's hyperbolic rank rigidity theorem (subject to the pinching condition) and also addresses some previously untouched curvature settings. The proof uses a nice geometric description of the dynamics of the frame flow given by Brin.

Algebra Seminar
Tuesday, March 13, 3:10-4:00
3096 EH
Jason Bell (Simon Fraser U)
Subfields of division algebras

We consider the quotient division algebras of finitely generated domains of finite GK dimension (that is, has polynomially bounded growth).

When the domain has GK dimension two over an algebraically closed field, we are able to show that if D is a subdivision algebra of the quotient division algebra then either the quotient division algebra is finite dimensional as a left and right D -vector space or it is a field of transcendence degree at most one over the base field. We then look at the extent to which these results can be generalized to higher GK dimension and will give some conjectures in this case.

Colloquium
Tuesday, March 13, 4:10-5:00pm
1360 EH
Gregory Margulis (Yale)
Polynomial divergence, unipotent flows, and effective ergodic theorems

I will explain the role of polynomial divergence in the theory of unipotent flows and how it in combination with effective ergodic theorems allows to give effective estimates in certain counting problems in multidimensional dynamics and number theory.

Student AIM Seminar
Wednesday, March 14, 3:10-4:00
3088 EH

Khachik Sargsyan (UM)

Mean First Passage Times and their Asymptotics in Markov Jump Processes

I am planning a chalkboard talk - mainly educational - on a class of continuous-time, discrete-state Markov Processes. First, will derive both Forward and Backward Kolmogorov Equations, then will investigate Mean First Passage Times (MFPT) between two states. Furthermore, the large system size limits of the process will be studied.

Applications from Chemical Kinetics and Population Dynamics will be provided, as time allows.

Geometric Function Theory Seminar
Wednesday, March 14, 3:10-4:00pm
4096 EH

Kai Rajala (U of Jyväskylä/UM Visiting Scholar)

Covering theorems for mappings of bounded and finite distortion

We discuss the covering properties of mappings of bounded and finite distortion. The main problem is to find the correct higher-dimensional analogs of Picard's theorem and Bloch's theorem on complex analytic functions. For mappings of bounded distortion the problem has essentially been solved, mainly by Rickman. The analogs have not been found for mappings of unbounded distortion.

AIM Seminar (Special Seminar)
Wednesday, March 14, 4:10-5:00
3096 EH

Stanley J. Osher (UCLA)

New and ultra fast methods for PDE based image processing

Graph cut techniques have reduced the speed of PDE based denoising algorithms down to that of taking an FFT. This is due to fast methods of J. Darbon, Boykov, Kolmogorov and others. With Darbon, we extended this approach to other algorithms such as deconvolution, where the fitting function is not local. I'll discuss this and new methods for restoration (based on NL means of Buades-Coll-Morel) which also can be speeded up by techniques taken from discrete applied math.

Commutative Algebra Seminar
Thursday, March 15, 3:10-4:00pm
3096 EH

Mel Hochster (UM)

Lech's conjecture in dimension 2

This is the second of two talks on how generic initial ideals were used by Lech to prove his conjecture in dimension 2. Results needed from the first talk will be recalled briefly.

**Financial/Actuarial Mathematics Seminar
Thursday, March 15, 3:10-4:00pm
3088 EH**

Volodymyr Babich (UM)

Dealing with Supplier Bankruptcy: the Costs and Benefits of Financial Subsidies

Risk of supply disruptions due to suppliers' financial problems plays a prominent role in manufacturers' risk portfolios. As recent examples from the automotive industry illustrate, even large suppliers (e.g. Delphi) could file for bankruptcy and manufacturer's actions, such as financial subsidies, could affect profoundly suppliers' financial states. Using a dynamic, stochastic, periodic-review model of manufacturer's joint operational and financial decisions and Merton-type model of supplier's bankruptcy, we address the following questions: (1) How can one model supplier's financial state and the relationship between supplier's financial state and supplier's operational performance? (2) What are the benefits to the manufacturer from giving financial subsidies to the suppliers, and what are the costs? (3) What are the optimal joint ordering and financial subsidy policies of the manufacturer? We provide conditions that allow the manufacturer to make the ordering decision independently from the subsidy decisions and, in particular, to use the traditional newsvendor critical fractile expression to choose the optimal order quantities. We show that the optimal subsidy policy has the "subsidy-up-to" structure. We perform comparative statics analysis and describe conditions when the powerful manufacturer may choose to share some of the supply chain profits with the supplier.

Study Seminar

**Thursday, March 15, 3:10-5:00pm
2866 EH**

Mario Bonk (UM)

Manifolds that are homeomorphic, but not diffeomorphic VII

We continue the sequence of lectures devoted to John Milnor's work on 7-spheres.

Differential Equations

**Thursday, March 15, 4:10-5:00pm
4096 EH**

Saleh Tanveer (OSU)

Divergent Series, Borel Summation and 3-D Navier-Stokes Equation

Divergent series occur naturally in asymptotic expansions of solutions to differential systems and can typically be calculated through an algorithmic process to any order desired; Borel summation provides an isomorphism between such divergent series expansion and actual functions they represent, under a whole range of algebraic operations, including addition, multiplication, composition, differentiation, etc. This isomorphism is similar to that between convergent series and analytic functions. Borel summability of a formal asymptotic series therefore provides an actual solution to the differential equations that gave rise to the formal expansion. We use Borel Transforms and Borel Summability to cast the 3-D Navier-Stokes equation into an integral equation on a half-line for which a unique solution is shown to exist, within a certain class of functions. In this reformulation of Navier-Stokes, the question of global existence can be posed as a question of asymptotics of a known solution. If the solution on the half-line is subexponential at ∞ , then global existence of classical solution would follow. The Borel based methods are also constructive and provide Gevrey-1 asymptotics for small time for analytic initial data. (joint work with O. Costin)

Math Club
Thursday, March 15, 4:10-5:00pm
2nd Floor Nesbitt Room
Danny Forger (UM)
Optimal Oscillations (How to Avoid Jet Lag)

When we travel across time zones, biological clocks within our bodies must synchronize to a new local time. I will present several relatively simple mathematical models for these clocks (e.g., harmonic oscillators, van der Pol oscillators, ...). Using these models, three mathematical techniques (one geometric, one stochastic, one variational) will be presented to determine “optimal” schedules to avoid jet lag.

Geometry & Physics (Special Seminar)
Thursday, March 15, 4:10-6:00pm
4088 EH
Kevin Costelo (Northwestern)
An algebraic characterization of Segal's category of moduli spaces

I'll show how Segal's category can be characterized (up to homotopy) in algebraic terms: it arises as the natural transformations between the Hochschild chains of a kind of Frobenius algebra up to homotopy. As an application, I'll give a (strange!) characterization of the Kontsevich-Witten generating function for intersection numbers on moduli space.

Applied and Interdisciplinary Mathematics Seminar
Friday, March 16, 3:10-4:00pm
1084 EH
Leonard Sander (UM)
Fluctuations Favor Fast Dispersal in Population Dynamics

Dispersal of species to find new resources is an important part of population dynamics. Migration rates can evolve in response to the relative success of different dispersal strategies. A rigorous mathematical analysis (Dockery, et al, 1998) showed that in a simplified deterministic treatment of two species which differ only in their dispersal rates the slow species always dominates. This would indicate that evolution would always favor slow dispersal. We demonstrate that fluctuations in an agent-based model can change this conclusion and can lead to dominance by the fast species or to coexistence, depending on parameters. We discuss two different effects of fluctuations, and show that our results are consistent with more complex treatments that find that selected dispersal rates are not monotonic with the cost of migration.