Fall 2008
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
September 29th – October 5th

Monday, September 29

3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Dave Anderson (UM) *Deformations of Morphisms of Curves* --- 2866 EH

3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- Shuichiro Takeda (Purdue) *The local Langlands conjecture for GSp(4)* --- 4096 EH

4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- Elizabeth Wulcan (UM) *On Bochner-Martinelli type residue currents* --- 3096 EH

4:10-5:00pm **Student Combinatorics** --- Austin Shapiro (UM) *Horn Conjecture II* --- 3866 EH

5:15-6:30pm **Teaching Mathematics** --- Yvonne Lai (UM) *Teaching Math Majors How to Teach* --- 3096 EH

Tuesday, September 30

2:10-3:00pm "**What is … " Seminar** --- Michael Thaddeus (U of Columbia) *What is … a Higgs bundle?* --- 3096 EH

3:10-4:00pm **Geometry Seminar** --- Yi Ni (Columbia U) *Floer homology and fibered 3-manifolds* --- 4096 EH

3:10-4:00pm **Algebra Seminar** --- Ryan Kinser (UM) *Rank functions and tensor products on rooted tree quivers* --- 3096 EH

3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH

4:10-5:00pm **Colloquium** --- Michael Thaddeus (Columbia University) *The Nash blow-up of a toric variety* --- 1360 EH

4:10-5:00pm **Student AIM Seminar** --- Paul Shearer (UM) *Machine Learning: Constructing Ensembles* --- 3088 EH

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

Wednesday, October 1

3:10-4:00pm **Geometric Function Theory Seminar** --- Mario Bonk (UM) *Conformal mappings and uniformization: A tribute to Oded Schramm* --- 4096 EH

3:10-4:00pm **Student Representation Theory Seminar** --- Harlan Kadish (UM) *Polynomial Invariants under Finite Group Actions* --- 3096 EH

3:10-4:00pm **Student Arithmetic Seminar** --- Hester Graves (UM) *The Fibonacci-Adics* --- 3866 EH

4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Not meeting this week --- 3096 EH

4:10-5:00pm **Applied and Interdisciplinary Mathematics Seminar (Special Seminar and Time/Location)** --- Ehud Yariv (Technion-IIT) *Electrokinetic Flows about Polarizable Particles* --- 4088 EH

4:10-6:00pm **Algebraic Geometry Seminar** --- Radu Laza (UM) *Triangulations of the sphere and degenerations of K3 surfaces* --- 3088 EH

Thursday, October 2

3:10-4:00pm **Commutative Algebra Seminar** --- Wenliang Zhang (UM) *F-jumping coefficients of principal ideals* --- 3096 EH

3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Virginia Young (UM) *Minimizing the Probability of Ruin When the Consumption is Ratcheted* --- 3088 EH

3:10-4:00pm **Topology Seminar** --- Yi Ni (MIT and AIM) *Dehn surgeries that reduce the Thurston norm of a fibered manifold* --- 4096 EH

4:10-5:00pm **Differential Equations** --- Lydia Bieri (Harvard) *An Extension of the Stability Theorem of the Minkowski Space in General Relativity* --- 4088 EH

Thursday, October 2 … continued

4:10-5:00pm **Math Club** --- Asen Dontchev (UM) *The Implicit Function Theorem* --- 2nd floor Nesbitt Common Room

4:10-5:00pm **Reading Group in Probabilistic Methods in Geometric Functional Analysis and Combinatorics** --- 1360 EH

4:10-6:00pm **Geometry & Physics** --- Not meeting this week --- 4096 EH

4:10-6:00pm **RTG Study Seminar** --- Pekka Pankka (UM) *Geometric rigidity of conformal matrices (after Faraco and Zhong)* --- 3866 EH

Friday, October 3

11:10-12:00pm **Theoretical Computer Science Seminar** --- Ye Du (UM) *Exchange Market Equilibria with Leontief's Utility: Freedom of Pricing Leads to Rationality* --- 3941 CSE

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Jeff Moehlis (UC-Santa Barbara) *Course-Grained Analysis of Collective Motion* --- 1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Kyle Ormsby (UM) *The Steenrod Algebra: Squares in the Homotopy of Spheres* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Nathan Reading (NCSU) *Noncrossing partitions and intersections of shards* --- 3866 EH

ABSTRACTS FOR THE WEEK OF SEPT. 29 – OCT. 3, 2008

Group Theory/Lie Theory/Number Theory Seminar
Monday, September 29, 3:10-5:00pm
4096 EH
Shuichiro Takeda (Purdue)
The local Langlands conjecture for GSp(4)

In the first part of the talk, I will give a more or less expository talk on the local Langlands conjecture in general, and then in the second part, I will show how to prove the local Langlands conjecture for GSp(4). This is a joint work with Wee Teck Gan.

Several Complex Variables and Complex Dynamics Seminar
Monday, September 29, 4:10-5:00pm
3096 EH
Elizabeth Wulcan (UM)
On Bochner-Martinelli type residue currents

Bochner-Martinelli type residue currents were introduced by Passare, Tsikh and Yger as a generalization of the classical Coleff-Herrera residue currents. In this talk we will discuss a geometric decomposition of these currents in terms of valuations. This is a joint work (in progress) with Mattias Jonsson.

Student Combinatorics
Monday, September 29, 4:10-5:00pm
3866 EH
Austin Shapiro (UM)
Horn Conjecture II

The Horn conjecture (now a theorem) addresses the following question:
If A and B are Hermitian matrices, how is the spectrum of A+B constrained by the spectra of A and B?

This problem has unexpected relations with several areas of mathematics, including representation theory, Schubert calculus, and the theory of endomorphisms of free modules over a ring. I will state results in these areas and sketch some of the connections as time permits. This talk is a continuation of a two-part series, but I will provide a recap for first-time attendees.

Teaching Mathematics
Monday, September 29, 3:10-4:00pm
3096 EH
Yvonne Lai (UM)
Teaching Math Majors How to Teach

This project was motivated by a desire to understand how students, in particular math majors, view teaching and learning how to teach. We report on a small seminar program in which a few mathematics undergraduates worked with graduate students at a weekend outreach program for high school students. During the pilot year 2007, we found that the undergraduate participants were uniformly surprised that teaching requires mathematical and pedagogical foresight. Additionally, while they were curious about techniques such as group work, in practice, they were hesitant to use them out of lack of confidence. These observations informed the design of the 2008 seminar. We will discuss the designs of the 2007 and 2008 seminars and share some stories about the undergraduate participants' insights into the process of becoming teachers. (Joint work with Hillel Raz, UC Davis)

"What is …" Seminar
Tuesday, September 30, 2:10-3:00pm
3096 EH
Michael Thaddeus (U of Columbia)
What is … a Higgs bundle?

I will review the moduli theory of Higgs bundles on a curve, as introduced in seminal papers of Hitchin and Simpson from the 1980's, and the correspondence theorem relating them to flat GL(n,C) connections. I will describe Hitchin's completely integrable Hamiltonian systems on these moduli spaces, and explain how, according to the recent work of Kapustin-Witten, they exhibit a physical duality which can be regarded as mirror symmetry or the electric-magnetic duality of Montonen-Olive.

Geometry Seminar
Tuesday, September 30, 3:10-4:00pm
4096 EH
Yi Ni (Columbia U)
Floer homology and fibered 3-manifolds

There are several Floer homologies of 3-manifolds defined using gauge theory and symplectic geometry. Three of them are Instanton Floer homology, Monopole Floer homology and Heegaard Floer homology. It turns out that each of these three homologies determines whether a 3-manifold is a surface bundle over the circle. I will give a survey on this topic, which will cover the works of Ghiggini, Ni, Juhasz, Kronheimer and Mrowka.

Algebra Seminar
Tuesday, September 30, 3:10-4:00pm
3096 EH
Ryan Kinser (UM)
Rank functions and tensor products on rooted tree quivers

A quiver representation is a diagram of vector spaces and linear maps. First, I'll talk about "rank functions" for quiver representations, which generalize the rank of a single linear map to measure something more global with respect to the collection of spaces and maps. Next we will look at how rank functions on rooted tree quivers (trees with a unique sink) can be partially ordered, leading to an application of rank functions to compute tensor product multiplicities.

Colloquium
Tuesday, September 30, 4:10-5:00pm
1360 EH
Michael Thaddeus (Columbia University)
The Nash blow-up of a toric variety

John Nash long ago introduced the Nash blow-up, which canonically associates to any algebraic variety a new variety with a proper birational morphism to the old one. It appears to make varieties smoother, so algebraic geometers have often wondered whether any variety can be desingularized by a finite sequence of Nash blow-ups. In the case of toric varieties, this question is equivalent to a simple question about convex polyhedra. I will exhibit experimental evidence, assembled by three Columbia undergraduates, for an affirmative answer to this question.

Student AIM Seminar
Tuesday, September 30, 4:10-5:00pm
3088 EH
Paul Shearer (UM)
Machine Learning: Constructing Ensembles

We will have our second talk on machine learning. We will be discussing methods of constructing good ensembles. We are reading from "Ensemble Methods in Machine Learning" by Thomas Deitterich. From that paper's abstract:
Ensemble methods are learning algorithms that construct a set of classifiers and then classify new data points by taking a weighted vote of their predictions. The original ensemble method is Bayesian averaging but more recent algorithms include error-correcting output coding Bagging, and boosting. This paper reviews these methods and explains why ensembles can often perform better than any single classifier. Some previous studies comparing ensemble methods are reviewed, and some new experiments are presented to uncover the reasons that Adaboost does not overfit rapidly.

Geometric Function Theory Seminar
Wednesday, October 1, 3:10-4:00pm
4096 EH
Mario Bonk (UM)
Conformal mappings and uniformization: A tribute to Oded Schramm

Oded Schramm's most important contribution to mathematics is the invention of the Stochastic-Loewner Equation (SLE), nowadays often called the Schramm-Loewner Evolution. This work evolved from his early interests in classical complex analysis and the theory of circle-packings. One can say that his contributions in this field were the most substantial since the time of Koebe. In my talk I will give a survey of this early part of Schramm's work.

Student Representation Theory Seminar
Wednesday, October 1, 3:10-4:00pm
3096 EH
Harlan Kadish (UM)
Polynomial Invariants under Finite Group Actions

Let G be a finite group acting on a finite dimensional k-vector space V. Then G also acts on the polynomial ring k[V]. Assume the order of G is a unit in k. Then using elementary commutative algebra and a powerful new tool, the Reynolds Operator, one can show that the subring of invariant polynomials in k[V] is finitely generated and is Cohen-Macaulay. This latter conditions means that the invariant subring is in fact a finite, free module over a polynomial ring.

Student Arithmetic Seminar
Wednesday, October 1, 3:10-4:00pm
3866 EH
Hester Graves (UM)
The Fibonacci-Adics

We will define, and explain, the Fibonacci-Adics.

Applied and Interdisciplinary Mathematics Seminar (Special Seminar and Time/Location)
Wednesday, October 1, 4:10-5:00pm
4088 EH
Ehud Yariv (Technion-IIT)
Electrokinetic Flows about Polarizable Particles

In traditional electrokinetic analyses it is common to postulate a prescribed surface charge density (or, alternatively, zeta potential). Implicit in that approach is the assumption of ideally non-polarizable surfaces, which are not affected by externally applied fields. Clearly, such an assumption is inappropriate to describe flows about electrically conducting surfaces, which are effectively infinitely polarizable. It may even be inappropriate for dielectric surfaces, which do possess a finite polarizability. Following recent experiments in flows about electrodes, there is now an increasing interest in electrokinetic flows about polarizable surfaces, where Debye-layer charge is induced by externally applied fields.
As in the more traditional fixed-charge electrokinetic analyses, prevailing models of induced-charge flows usually employ the thin-Debye-layer limit. The electrokinetic transport occurring within the Debye layer is then effectively lumped into respective no-flux and slip boundary conditions, governing the electric and flow fields. The archetypical problem in such flows entails an uncharged conducting spherical particle (say a metal sphere) which is suspended in an unbounded fluid domain. When placed under an externally imposed Faraday current, the particle becomes polarized and a quadrupolar flow structure is formed. Because of the high symmetry in that problem, the ensuing electrokinetic flow does not result in particle motion. Unsurprisingly, then, current interest lies in asymmetric configurations, which can result in electrophoretic motion of zero-net-charge particles. In the first part of the talk I will describe how asymptotic methods and symmetry arguments help in understanding this phenomenon. For sub-micron particles, the thin-layer model breaks down. In the second part of the talk I will present a general analysis for an arbitrary layer thickness. Many of the electrokinetic concepts (e.g. zeta potential) associated with the thin-layer limit lose their concrete meaning in that general case, where instead of slip-driven electro-osmosis one encounters force-driven electro-convection. Thus, a systematic investigation of the electro-kinetic flow requires a confrontation with the highly-coupled nonlinear electrokinetic equations. Fortunately, the small particle size allows linearization with respect to the external field intensity. Of special interest is the thick- Debye-layer limit, which applies to nano-particles. This limit is singular and requires a systematic use of inner-outer asymptotic expansions, in the spirit of Proudman & Pearson (1957).

Commutative Algebra Seminar
Thursday, October 2, 3:10-4:00pm
3096 EH
Wenliang Zhang (UM)
F-jumping coefficients of principal ideals

We will prove that, in an excellent regular local ring of positive characteristic, all F-jumping coefficients of any principal ideal are rational and they form a discrete subset of the set of real numbers.

Financial/Actuarial Mathematics
Thursday, October 2, 3:10-4:00pm
3088 EH
Virginia Young (UM)
Minimizing the Probability of Ruin When the Consumption is Ratcheted

We assume that an agent's rate of consumption is ratcheted; that is, it forms a nondecreasing process. We assume that the agent invests in a financial market with one riskless and one risky asset, with the latter's price following geometric Brownian motion as in the Black-Scholes model. Given the rate of consumption, we act as financial advisers and find the optimal investment strategy for the agent who wishes to minimize his probability of ruin. To solve this minimization problem, we use techniques from stochastic optimal control. (This is a joint work with Erhan Bayraktar.)

Differential Equations
Thursday, October 2, 4:10-5:00pm
4088 EH
Lydia Bieri (Harvard)
An Extension of the Stability Theorem of the Minkowski Space in General Relativity

The talk addresses the global, nonlinear stability of solutions of the Einstein equations in General Relativity. In particular, it deals with the initial value problem for the Einstein vacuum equations, generalizing the results of D. Christodoulou and S. Klainerman in 'The global nonlinear stability of the Minkowski space'. Every strongly asymptotically flat, maximal, initial data which is globally close to the trivial data gives rise to a solution which is a complete spacetime tending to the Minkowski spacetime at infinity along any geodesic. We consider the Cauchy problem with more general, asymptotically flat initial data. This yields a spacetime curvature which is not bounded in L^{∞} any more. The main proof is based on a bootstrap argument. To close the argument, we have to show that the spacetime curvature and the corresponding geometrical quantities have the required decay. In order to do so, the Einstein equations are decomposed with respect to specific foliations of the spacetime.

Math Club
Thursday, October 2, 4:10-5:00pm
2nd floor Nesbitt Common Room
Asen Dontchev (UM)
The Implicit Function Theorem

The classical implicit function theorem revolves around solving an equation f(p,x)=0 for x in terms of p . It is a centerpiece of mathematical analysis with countless applications, but there is much more to it than usually comes to attention. In this talk, in a departure from the treatments common in textbooks, the set of all pairs (p,x) with f(p,x)=0 is viewed as the graph of a generally set-valued mapping S, called the solution mapping for the equation. In this context, the question is recast as whether a localization of S around a pair (p',x') in the graph of S is actually the graph of a (single-valued) function s, and, if so, what properties can be guaranteed for that function s.
The classical inverse function theorem is a special case of the classical implicit function theorem. It is, in fact, equivalent to the classical implicit function theorem, as is the classical correction function theorem. After a discussion of these results, it will be demonstrated that the differentiability assumptions can be relaxed by utilizing Lipschitz continuity.

RTG Study Seminar
Thursday, October 2, 4:10-6:00pm
3866 EH
Pekka Pankka (UM)
Geometric rigidity of conformal matrices (after Faraco and Zhong)

A classical theorem of Liouville(-Gehring-Reshetnyak) states that a conformal mapping from a domain in R^n to R^n is a restriction of a Möbius mapping if n > 2. An interesting related question is to try to estimate the distance of a general mapping to the set of Möbius mappings in terms of the distance of the differential to the set of conformal matrices. I will discuss recent results of Faraco and Zhong into this direction.

Applied and Interdisciplinary Mathematics Seminar
Friday, October 3, 3:10-4:00pm
1084 EH
Jeff Moehlis (UC-Santa Barbara)
Course-Grained Analysis of Collective Motion

We apply the "equation-free" coarse-grained computational framework to understand the population-level behavior for a model for schooling fish. In particular, we focus on a case for which the model can give co-existing stable stationary and mobile collective behaviors. Stochastic effects cause the school to switch between these behaviors, leading to stick-slip dynamics which can be characterized using an effective potential in terms of a population-level coarse variable. The effective potentials found using equation-free techniques compare very favorably with those obtained (with much more computational effort) from long-time simulations.

Student Geometry/Topology
Friday, October 3, 3:10-4:00pm
3096 EH
Kyle Ormsby (UM)
The Steenrod Algebra: Squares in the Homotopy of Spheres

The Steenrod algebra A* encodes the algebraic structure of the Steenrod squares, the stable mod 2 cohomology operations. It plays a special role in homotopy theory because the mod 2 cohomology ring of any topological space is a highly structured algebra over A*. I will investigate the construction and formal properties of the Steenrod squares and specify the algebraic structure of A*. If time permits, I will indicate how the homological algebra of A* approximates the stable homotopy of spheres. To mitigate the decidedly algebraic nature of this talk, I will draw several pictures.

Combinatorics
Friday, October 3, 4:10-5:00pm
3866 EH
Nathan Reading (NCSU)
Noncrossing partitions and intersections of shards

We introduce a new partial order (in fact, lattice) $\Psi(W)$ on a finite Coxeter group W, weaker than the weak order and having the noncrossing partition lattice $NC(W)$ as a sublattice. This provides, in particular, a new proof that $NC(W)$ is a lattice. The lattice $\Psi(W)$ is graded and atomic and its rank generating function is the W-Eulerian polynomial. Many order-theoretic properties of $\Psi(W)$, like Möbius number, number of maximal chains, etc., are exactly analogous to the corresponding properties of $NC(W)$. Furthermore, viewing NC(W) as a sublattice of $\Psi(W)$ leads to new proofs of the known properties of NC(W).

Shards are certain codimension-1 polyhedral cones that govern the lattice theory of the weak order on W. The reflecting hyperplanes are cut into shards according to a simple rule. The collection of arbitrary intersections of shards forms a lattice under reverse containment. Surprisingly there is a bijection between intersections of shards and elements of W. Furthermore, this bijection is an isomorphism between the lattice of intersections of shards and $\Psi(W)$. The realization in terms of shards is the key to most of what can be proved about $\Psi(W)$. This geometric approach also brings to light close connections between $NC(W)$ and semi-invariants of quivers.

For those less familiar with Coxeter groups, I will illustrate the definitions and results with a running example, taking W to be the symmetric group S_4.