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

Monday, November 12

3:10-4:00pm **Student Analysis Seminar** --- Chris Hammond (UM) *Hormander's Solution of the d-Bar Problem on Pseudoconvex Domains, Part Two* --- 3866 EH
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Renzo Cavalieri (UM) *On an example of Hacking* --- 2866 EH
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Ju-Lee Kim (MIT) TBA --- 4096 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Sebastien Boucksom (CNRS, Paris) *Transfinite diameter and energy functionals on projective varieties* --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- Mark Gross (UCSD) *Tropical geometry and mirror symmetry* --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Darryl Koch (UM) *Intervention Strategy for Improving Success Rates in Calculus* --- 3088 EH

Tuesday, November 13

2:10-3:00pm "**What is … " Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Algebraic Geometry Seminar (Special Seminar)** --- Vadim Vologodsky (U of Chicago) *The conjugate filtration on the ring of differential operators in characteristic p* --- 1068 EH
3:10-4:00pm **Geometry Seminar** --- TBA --- 4088 EH
3:10-4:00pm **Algebra Seminar** --- Sophie Morier-Genoud (UM) *Toric degenerations of G-variety and Canonical basis* --- 3088 EH
3:10-4:00pm **Student Representation Theory/Lie Theory Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Colloquium** --- Not meeting this week --- 1360 EH

Wednesday, November 14

3:10-4:00pm **Geometric Function Theory Seminar** --- Kai Rajala (Univ. of Jyvaskyla) *Quasiconformal frames* --- 4096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- Ben Weiss (UM) *Mahler Measure, part 2*--- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- Matt Elsey (UM) *Analogue of the Rudin-Osher-Fatemi Total Variation Model for Fairing Surfaces* --- 3096 EH
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Elizabeth Wulcan (Chalmers University) *Hypermeromorphic currents* --- 4088 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Richard Rimanyi (UNC) *Equivariant classes of matroid realization spaces* --- 3088 EH

Thursday, November 15

2:10-3:00pm **Working Group in Integrable Systems and Asymptotics (Special Seminar)** --- Michael Gekhtman (Notre Dame) *Cubic peakons and Cauchy bi-orthogonal polynomials* --- 1372 EH
2:10-3:00pm **Student Algebraic Geometry Seminar** --- Kyle Hofmann (UM) *Triangulations of algebraic sets* --- 3866 EH
2:10-3:00pm **Study Seminar (Pt. 1)** --- Jon Handy (UM) *Wolff's Proof of the Corona Theorem, Part 1* --- 3096 EH
3:10-4:00pm **Study Seminar (Pt. 2)** --- Jon Handy (UM) *Wolff's Proof of the Corona Theorem, Part 1 (cont.)* --- 4088 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Virginia Young (UM) *Pricing Options in Incomplete Equity Markets via the Instantaneous Sharpe Ratio* --- 3088 EH

Thursday, November 15 .. continued

3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Tor, Ext, and local cohomology … continued* --- 3096 EH

3:10-4:00pm **Topology Seminar** --- Ralph Kaufman (Purdue Univ) *From foliations to actions* --- 4096 EH

4:10-5:00pm **Differential Equations** --- Not meeting this week --- 4088 EH

4:10-5:00pm **Math Club** --- Hannah Markwig (UM) *Tropical math, or why 3+5=5 sometimes* --- 2nd Floor Nesbitt Room

4:10-5:00pm **Student Combinatorics** --- Kelli Talaska (UM) *Tutte's polynomial* --- 3866 EH

Friday, November 16

10:50-12:00pm **EECS Theory Seminar (SODA '08 practice talks)** --- 1. Mark Iwen (UM) *A Deterministic Sub-linear Time Sparse Fourier Algorith via Non-adaptive Compressed Sensing Methods,* 2. Ran Duan (UM) *Bounded Leg Distance and Reachability Oracles* --- CSE 3941

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Paul Newton (USC) *Vortex lattice theory* ---1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Marshall Williams (UM) *Introduction to Currents* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Roman Vershynin (UC Davis) *Randomness in functional analysis: toward universality* --- 3866 EH

UPCOMING EVENTS

Rainich Lecture
Jan. 15-17, 2008
Speaker: Gang Tian

Ziwet Lecture
Feb. 5, 2008
Speaker: Curtis McMullen

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

Student Analysis Seminar
Monday, November 12, 3:10-4:00pm
3866 EH
Chris Hammond (UM)
Hormander's Solution of the d-Bar Problem on Pseudoconvex Domains, Part Two

We will provide an overview of Hörmander's method for solving the d-Bar Equation on pseudoconvex domains. The solution involves some functional analysis on appropriately chosen Hilbert spaces.

Several Complex Variables Seminar
Monday, November 12, 4:10-5:00pm
3096 EH
Sebastien Boucksom (CNRS, Paris)
Transfinite diameter and energy functionals on projective varieties

I will explain a recent joint work with R. Berman in which we define and investigate several natural generalizations of classical notions of capacity to a the setting of quasi-psh functions on compact complex manifolds. This enables us to recover by purely complex analytic means and on an arbitrary projective manifold a recent generalization by Rumely of Robin's formula to $\mathbb{C}^n$.

Geometry & Physics
Monday, November 12, 4:10-6:00pm
4088 EH
Mark Gross (UCSD)
Tropical geometry and mirror symmetry

I will explain some recent developments in understanding both sides of the mirror symmetry story in terms of tropical geometry. Starting from an integral affine manifold with singularities (i.e. a real manifold with coordinate charts off of a codimension two set, all of whose transition maps are integral affine linear), one can build a mirror pair of Calabi-Yau manifolds. Tropical data on the affine manifold (data of a piecewise linear nature) is related to holomorphic curves on one of the Calabi-Yau manifolds and period information on the other one. This picture is still largely conjectural, but already leads to some new and testable enumerative predictions counting certain kinds of curves on weight projective planes.

Teaching Mathematics
Monday, November 12, 5:15-6:30pm
3088 EH
Darryl Koch (UM)
Intervention Strategy for Improving Success Rates in Calculus

Engineering students at the University of Michigan are required to pass a set of core courses in mathematics and science during their first and second years before selecting a specific engineering department as their major. Success in these core courses is a critical factor for retention. In particular, our data suggests that success in Calculus I is very strongly correlated to eventual graduation in engineering. Entering first-year students are recommended for pre-calculus or calculus based on high school profile information (high school GPA and college test scores) and a placement exam administered by the Mathematics Department. Even though great care is involved in placing students in the correct course, it is possible that students may enroll in calculus without being adequately prepared, or a combination of other factors (heavy courseload, inadequate study skills, etc.) may prevent them from achieving success in that critical course. To improve the success rate in calculus for engineering students, the College, in collaboration with the Mathematics Department, recently instituted an “early warning” approach. If a student performs poorly on the first exam in Calculus I, he or she has the option of switching into an intensive precalculus course at midterm, with no penalty, before re-enrolling in calculus the following term. This intensive precalculus course is designed to help students develop the math skills and necessary study skills to ensure their success in calculus in the following term. In this paper, we will present the data that describes the correlation between success in Calculus I and eventual graduation, the logistics required to quickly identify students who may require this intervention and enroll them in a half-term course, the details of the course, and the effect of such an intervention on the success rate in calculus.

Algebraic Geometry Seminar (Special Seminar)
Tuesday, November 13, 3:10-4:00pm
1068 EH
Vadim Vologodsky (U of Chicago)
The conjugate filtration on the ring of differential operators in characteristic p

The ring D of differential operators in characteristic p, besides the order filtration, has another natural filtration induced by a filtration on the center of D. The associated graded algebra is a canonically split Azumaya algebra over the cotangent space. I will explain how this construction combined with the formalism of filtered derived categories leads to a generalization of Katz's formula relating the p-curvature and the Kodaira-Spencer operator. This is a joint work with Arthur Ogus.

Algebra Seminar
Tuesday, November 13, 3:10-4:00pm
3088 EH
Sophie Morier-Genoud (UM)
Toric degenerations of G-variety and Canonical basis

I will describe a method to construct toric degenerations of projective varieties endowed with an action of semisimple Lie group G.
The method was introduced by Caldero in 2000 in the case of flag varieties and Schubert varieties. The polytopes corresponding to the toric varieties are described using the combinatorics of the Kashiwara-Lusztig canonical basis associated to G. I will give properties of these polytopes and consequences in the problem of mirror symmetry.

Geometric Function Theory Seminar
Wednesday, November 14, 3:10-4:00pm
4096 EH
Kai Rajala (Univ. of Jyvaskyla)
Quasiconformal frames

We define QC frames in the n-space as n-tuples of 1-forms satisfying a QC condition and an asymptotic closedness condition. We show that blowing up a QC frame at a point gives branched QC tangent maps, which reveal topological information about the frame. The goal is to generalize results of Heinonen, Keith, Rickman and Sullivan on Cartan-Whitney presentations from the branched bi-Lipschitz to the branched QC setting. This is joint work with Juha Heinonen and Pekka Pankka.

Student Arithmetic Seminar
Wednesday, November 14, 3:10-4:00pm
3866 EH
Ben Weiss (UM)
Mahler Measure, part 2

The goal of these two talks will be to introduce Mahler Measure and height from first principles, and go over some of their basic properties and motivation. We will then introduce the concept of entropy on a torus by a map (represented by a matrix), and prove the amazing result that the entropy is the Mahler Measure of the characteristic polynomial of said matrix.

Student AIM Seminar
Wednesday, November 14, 3:10-4:00pm
3096 EH
Matt Elsey (UM)
Analogue of the Rudin-Osher-Fatemi Total Variation Model for Fairing Surfaces

We propose a model for surface fairing that preserves edges more effectively than current standard models (e.g. minimization of total or mean curvature). The majority of this talk focuses on the way in which our model is found as an analogue of the Rudin-Osher-Fatemi TV model, which is well-known to preserve discontinuities in image denoising applications. We will conclude by presenting some numerical results from an implementation of our model.

Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, November 14, 4:10-5:30pm
4088 EH
Elizabeth Wulcan (Chalmers University)
Hypermeromorphic currents

(Joint work with Mats Andersson) We introduce a class of currents, which we call hypermeromorphic and which includes meromorphic currents such as principal value and residue currents. We discuss some basic properties; in particular, we show that hypermeromorphic currents allow for multiplication with characteristic functions 1W, where W is a variety or more generally a constructible set. The motivation is that we by such a calculus obtain a natural geometric decomposition of residue currents.

Algebraic Geometry Seminar
Wednesday, November 14, 4:10-6:00pm
3088 EH
Richard Rimanyi (UNC)
Equivariant classes of matroid realization spaces

We will discuss equivariant classes represented by invariant varieties in a representation, some motivations (singularity theory, Schubert calculus, cohomology rings of moduli spaces), and computational strategies. The example of matroid realization spaces will be considered in detail, with applications to school geometry (eg. Given 8 generic lines l_1, ..., l_8, and a point Q in the plane, how many Pappus configurations P_1, ...P_9 exist with P_i l_i, and P_9 = Q?). Joint work with L. Feher, A. Nemethi

Student Algebraic Geometry Seminar
Thursday, November 15, 2:10-3:00pm
3866 EH
Kyle Hofmann (UM)
Triangulations of algebraic sets

Following an exposition of Hironaka, we will show that any semialgebraic set in R^n admits a triangulation. This implies that any quasiprojective variety is a well-behaved topological space, and that the techniques of algebraic topology can be applied to it. The proof is elementary and constructive.

Study Seminar (Pt. 1) & (Pt. 2)
Thursday, November 15, (Pt. 1) 2:10-3:00 & (Pt. 2) 3:10-4:00
(Pt. 1) 3096 EH & (Pt. 2) 4088 EH
Jon Handy (UM)
Wolff's Proof of the Corona Theorem, Part 1

Carleson's original proof of the corona theorem for the unit disc in 1962 was very difficult, but in 1980 Thomas Wolff discovered a much simpler, graceful proof. (Word spread so quickly he never had to publish the proof himself!) Since the theory of Hardy spaces is not as fashionable as it once was, we will begin this week by examining the interaction of the geometry of analytic functions in the disc with the geometry of the boundary (the unit circle) and with measures in the disc with certain geometric properties.

Financial/Actuarial Mathematics Seminar
Thursday, November 15, 3:10-4:00pm
3088 EH
Virginia Young (UM)
Pricing Options in Incomplete Equity Markets via the Instantaneous Sharpe Ratio

We develop a theory for pricing in incomplete equity markets by assuming that the investor issuing an unhedgeable derivative security requires compensation for this risk in the form of a pre-specified instantaneous Sharpe ratio. In this talk, we apply our method to price options on non-traded assets for which there is a traded asset that is correlated to the non-traded asset. We use comparison arguments to demonstrate that the price satisfies a number of desirable properties. In the associated paper, we apply our method to price options in the presence of stochastic volatility, but we will not present that work in the talk.
This is joint work with Erhan Bayraktar.

Commutative Algebra Seminar
Thursday, November 15, 3:10-4:00pm
3096 EH
Mel Hochster (UM)
Tor, Ext, and local cohomology …. continued

For the first several weeks of the semester, I will be giving some talks on elementary homological algebra: the functors Tor and Ext, and then an introductory treatment of local cohomology. I will write up these lectures and make them available from my Web page. This is intended to supplement the background of students in Math 711, but others who are interested in this material are welcome.

Topology Seminar
Thursday, November 15, 3:10-4:00pm
4096 EH
Ralph Kaufman (Purdue Univ)
From foliations to actions

Joint with R.C. Penner we introduced what could be called a combinatorial models of open/closed conformal field theory. It is based on partially measured foliations on surfaces with boundaries and marked points on the boundaries. From this geometry we derived actions of certain moduli spaces of surfaces on Hochschild cochains of a Frobenius algebra which extend our proofs of Deligne's conjecture and its cyclic generalization. This has applications in string topology. First, we will review the operadic structures on the geometric level and chain level. Then, we will construct the action using so-called operadic correlation functions and graph Feynman rules. We end with an outlook on further research and a connection to D-branes.

Math Club
Thursday, November 15, 4:10-5:00pm
2nd Floor Nesbitt Room
Hannah Markwig (UM)
Tropical math, or why 3+5=5 sometimes

In algebraic geometry, we can study geometric objects (e.g. plane curves) with the help of their defining equation. For example, the equation x^2-y=0 defines a parabola in the plane and we may try to describe its properties using the equation. Polynomial equations are sometimes hard, so we replace them with tropical polynomials. In tropical math, the operations of addition and multiplication are different. For example, 3+5=5 tropically. We will see how tropical polynomials can define plane curves that look a lot different from curves you are used to. A tropical line will, for example, consist of three infinite rays meeting at a vertex. We will see that these weird objects are still similar to usual curves, and can be useful for studying ordinary curves!

Student Combinatorics
Thursday, November 15, 4:10-5:00pm
3866 EH
Kelli Talaska (UM)
Tutte's polynomial

Tutte's polynomial is a two-variable polynomial which can be thought of as a generalization of the chromatic polynomial, which encodes the number of vertex colorings of a graph. It is defined recursively, using edge contraction and deletion. We will look at a number of graph invariants which can be obtained as specializations of the Tutte polynomial.

Applied and Interdisciplinary Mathematics Seminar
Friday, November 16, 3:00-4:00pm
1084 EH
Paul Newton (USC)
Vortex lattice theory

Recent experiments on the formation of vortex lattices in Bose-Einstein condensates has produced the need for a mathematical theory that is capable of predicting a broader class of lattice patterns, ones that are free of discrete-symmetries and can form in a random environment. In this talk, I will describe an N-particle based Hamiltonian theory which, if formulated in terms of the interparticle distances, leads to the analysis of a non-normal `configuration' matrix whose nullspace structure determines the existence or non-existence of a lattice. The singular value decomposition of this matrix leads to a method in which all lattice patterns, in principle, can be identified and calculated by a random-walk scheme which systematically uses the m-smallest singular values as a ratchet mechanism to home in on lattices with many new properties, including a complete lack of discrete symmetries and heterogeneous particle strengths.

Student Geometry/Topology
Friday, November 16, 3:10-4:00pm
3096 EH
Marshall Williams (UM)
Introduction to Currents

In this talk I will introduce k-dimensional currents, which generalize the notion of a k-dimensional submanifold in Euclidean space. One of the main motivations for this generalization is the need, particularly in variational problems, for completeness and compactness properties not satisfied by spaces of submanifolds. I will introduce two versions of this theory. In the first part of the talk, I will give a brief overview of the theory of currents in Euclidean spaces described by Federer and Fleming in 1960. In the second half, I will describe a recent generalization of the theory to arbitrary metric spaces, introduced by Ambrosio and Kirchheim in 2000.

Combinatorics
Friday, November 16, 4:10-5:00pm
3866 EH
Roman Vershynin (UC Davis)
Randomness in functional analysis: toward universality

The probabilistic method has redefined functional analysis in high dimensions. Random spaces and operators are to analysis what random graphs are to combinatorics. They provide a wealth of examples that are otherwise hard to construct, suggest what situations we should view as typical, and they have far-reaching applications, most notably in convex geometry and computer science. With the increase of knowledge about random structures one begins to wonder about their universality. Is there a limiting picture as the dimention increases to infinity? Is this picture unique and independent of the distribution? What are the deterministic implications of probabilistic methods? This talk will survey progress on some of these problems, in particular a proof of a conjecture of Von Neumann and Goldstine on random operators and its connections to the Littlewood-Offord problem in extremal combinatorics.