

Fall 2008
University of Michigan-Department of Mathematics
<http://www.math.lsa.umich.edu/seminars/index.shtml>
Ann Arbor, MI 48109-1043
October 13th – October 19th

Monday, October 13

- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Kevin Tucker (UM) *Fano Varieties are Rationally Connected (Bend and Break)* --- 2866 EH
- 3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- David Whitehouse (MIT) *Applications of the Relative Trace Formula to Central L-values* --- 4096 EH
- 4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- David Barrett (UM) *Holomorphic projection and duality for domains in complex projective space* --- 3096 EH
- 4:10-5:00pm **Student Combinatorics** --- Florian Block (UM) *Hilbert Scheme I* --- 3866 EH
- 5:15-6:30pm **Teaching Mathematics** --- Nkem Khumbah (UM) *Michigan Calculus Achievement Program (M-CAP): Overview and Prospects* --- 3096 EH

Tuesday, October 14

- 3:10-4:00pm **Geometry Seminar** --- Yael Algom Kfir (U Utah) *Negative curvature phenomena in Outer Space* --- 4096 EH
- 3:10-4:00pm **Algebra Seminar** --- Not meeting this week --- 3096 EH
- 3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH
- 4:10-5:00pm **Colloquium** --- Brendan Hassett (Rice University) *Approximation results for varieties of low degree* --- 1360 EH
- 4:10-5:00pm **Student AIM Seminar** --- Kris Reyes (UM) *Machine Learning: Neural Networks* --- 3088 EH

Wednesday, October 15

- 3:10-4:00pm **Geometric Function Theory Seminar** --- Peter Duren (UM) *Schwarzian derivatives of analytic and harmonic functions* --- 4096 EH
- 3:10-4:00pm **Student Representation Theory Seminar** --- Farkhod Eshmatov (UM) *A-infinity algebras and modules* --- 3096 EH
- 3:10-4:00pm **Student Arithmetic Seminar** --- Ben Weiss (UM) *Measure Theory Of Continued Fractions* --- 3866 EH
- 4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Not meeting this week --- 3096 EH
- 4:10-6:00pm **Algebraic Geometry Seminar** --- Brendan Hassett (UM) *Rational curves on holomorphic symplectic varieties* --- 3088 EH

Thursday, October 16

- 3:10-4:00pm **Commutative Algebra Seminar** --- Florian Enescu (Georgia State U) *Anti-nilpotent modules and primary decomposition with respect to Frobenius* --- 3096 EH
- 4:10-6:00pm **Geometry and Physics Seminar** --- Mohammed Abouzaid (MIT) *A restriction functor in wrapped Floer homology* --- 4096 EH
- 4:10-5:00pm **Differential Equations** --- Monica Visan (U Chicago) *Nonlinear Schrodinger equations at critical regularity* --- 4088 EH
- 4:10-5:00pm **Math Club** --- Katharine Walker (UM) *Brouwer's Fixed Point 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 **RTG Study Seminar** --- Lars Lauder (UM) *A topological characterization of hyperbolic groups (After Bowditch)* --- 3866 EH

Friday, October 17

- 11:10-12:00pm **Theoretical Computer Science Seminar** --- Andrey Goder (UM) "*A Lower Bound on the Competitive Ratio of Truthful Auctions*" by Goldberg et al. --- CSE 3941
- 3:10-4:00pm **Financial/Actuarial Mathematics Seminar (Non-standard Day)** --- Paolo Guasoni (Boston University) *Portfolios and Risk Premia for the Long Run* --- 3088 EH
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Joseph Fehribach (Worcester Polytechnic Inst) *Vector Space Methods for Reaction Networks and Kirchhoff Graphs* --- 1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- Not meeting this week --- 3096 EH
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar (Special Seminar)** --- Rowan Killip (UCLA) *Some Operators with Random Matrix Eigenvalue Statistics* --- 1084 EH
- 4:10-5:00pm **Combinatorics** --- Alexander Barvinok (UM) *On 0-1 matrices with prescribed row and column sums* --- 3866 EH

ABSTRACTS FOR THE WEEK OF OCT. 13 – OCT. 19, 2008

Group Theory/Lie Theory/Number Theory Seminar
Monday, October 13, 3:10-5:00pm
4096 EH
David Whitehouse (MIT)
Applications of the Relative Trace Formula to Central L-values

I will describe some applications of the relative trace formula to central values of twisted quadratic base change L-functions. The first is to prove explicit formulae, generalizing work of Gross and Zhang (amongst others), relating these central values to integrals of automorphic forms over tori. The second is to obtain exact average value results for Hilbert modular forms. If time permits I will discuss extensions of this work to higher rank. Parts of this talk are based on separate joint works with Kimball Martin and Brooke Feigon.

Several Complex Variables and Complex Dynamics Seminar
Monday, October 13, 4:10-5:00pm
3096 EH
David Barrett (UM)
Holomorphic projection and duality for domains in complex projective space

We show that the efficiency of a natural pairing between certain projectively invariant Hardy spaces on dual strongly C-linearly convex real hypersurfaces in complex projective space is measured by the norm of the corresponding Leray transform.

Teaching Mathematics
Monday, October 13, 5:15-6:30pm
3096 EH

Nkem Khumbah (UM)

Michigan Calculus Achievement Program (M-CAP): Overview and Prospects

Drawing from the implementation structure of Michigan's introductory mathematics program, the Comprehensive Studies Program and the Mathematics Department started the Michigan Calculus Achievement Program (M-CAP) with Martin Luther King High School in Detroit two years ago, in an effort to familiarize students from the Detroit Public Schools with the rigor and expectations of programs similar to Michigan. I will discuss our experiences and prospects.

Geometry Seminar
Tuesday, October 14, 3:10-4:00pm
4096 EH

Yael Algom Kfir (U of Utah)

Negative curvature phenomena in Outer Space

There is a striking analogy between the mapping class group of a surface and $\text{Out}(F_n)$, the outer automorphism group of a free group of rank n . Outer space, a finite dimensional, contractible cell complex which admits an $\text{Out}(F_n)$ action plays the role of Teichmueller space in the $\text{Out}(F_n)$ setting. Minsky showed that projections to geodesics in the thick part of Teichmueller space are strongly contracting. I will discuss how this property implies that the space is negatively curved in that direction. I will then sketch a proof of an analogue of Minsky's theorem for Outer space.

Colloquium
Tuesday, October 14, 4:10-5:00pm
1360 EH

Brendan Hassett (Rice University)

Approximation results for varieties of low degree

In the 1930's, C.C. Tsen showed that a homogeneous polynomial over the function field of a complex projective curve has a nontrivial solution provided the degree of the polynomial is less than the number of variables. In 2001 Graber, Harris, and Starr generalized this result by proving that every rationally connected variety over the function field of a curve has a rational point. We can recast this in geometric terms: If $f: X \rightarrow B$ is surjective map from a smooth projective variety to a curve with rationally connected fibers, then f admits a section. Once we know that a section exists, we can ask approximation questions about the sections: Can we find a section through a prescribed set of points? With prescribed Taylor series at those points? Our results depend on the singularities occurring in the fibers of f . (joint with Y. Tschinkel)

Student AIM Seminar
Tuesday, October 14, 4:10-5:00pm
3088 EH
Kris Reyes (UM)
Machine Learning: Neural Networks

We continue our discussion about machine learning. I will discuss neural and Bayesian networks. From "A Tutorial on Learning with Bayesian Network" by David Heckerman:
A Bayesian network is a graphical model that encodes probabilistic relationships among variables of interest. When used in conjunction with statistical techniques, the graphical model has several advantages for data analysis. One, because the model encodes dependencies among all variables, it readily handles situations where some data entries are missing. Two, a Bayesian network can be used to learn causal relationships, and hence can be used to gain understanding about a problem domain and to predict the consequences of intervention. Three, because the model has both a causal and probabilistic semantics, it is an ideal representation for combining prior knowledge (which often comes in causal form) and data. Four, Bayesian statistical methods in conjunction with Bayesian networks offer an efficient and principled approach for avoiding the overfitting of data.

Geometric Function Theory Seminar
Wednesday, October 15, 3:10-4:00pm
4096 EH
Peter Duren (UM)
Schwarzian derivatives of analytic and harmonic functions

This talk will survey classical applications of the Schwarzian derivative of an analytic function, with emphasis on univalence criteria. We will also describe a generalization of the Schwarzian to a complex-valued harmonic function, defined in terms of its canonical lift to a minimal surface. For both analytic and harmonic functions, various bounds on the Schwarzian lead to univalence criteria and estimates of valence. Similar methods give injectivity results for curves in \mathbb{R}^n and \mathbb{C}^n . (Joint work with Martin Chuaqui and Brad Osgood.)

Student Representation Theory Seminar
Wednesday, October 15, 3:10-4:00pm
3096 EH
Farkhod Eshmatov (UM)
A-infinity algebras and modules

This is an introductory talk on A-infinity algebras and their modules. I will define A-infinity algebras and explain their topological origin. I will also motivate the introduction of these algebras by presenting some basic problems from homological algebra.

Algebraic Geometry Seminar
Wednesday, October 15, 4:10-6:00pm
3088 EH

Brendan Hassett (Rice University)
Rational curves on holomorphic symplectic varieties

Let (S, g) be a complex polarized K3 surface. There is a beautifully explicit description of the ample divisors on S , depending only on the Hodge structure/intersection form on the middle cohomology of S and the polarization g . We discuss extensions of this result to higher-dimensional holomorphic symplectic varieties, with special attention to those deformation equivalent to Hilbert schemes of K3 surfaces. We will present detailed results in dimension four and some new conjectures in higher dimensions. (joint w. Tschinkel)

Commutative Algebra Seminar
Thursday, October 16, 3:10-4:00pm
3096 EH

Florian Enescu (Georgia State U)
Anti-nilpotent modules and primary decomposition with respect to Frobenius

The talk will present the notion of anti-nilpotent modules and discuss ways of developing a primary decomposition theory for modules with Frobenius action over a ring of prime characteristic. Part of the work is joint with M. Hochster.

Geometry and Physics Seminar
Thursday, October 16, 4:10-6:00pm
4096 EH

Mohammed Abouzaid (MIT)
A restriction functor in wrapped Floer homology

One of the main problems in the study of symplectic topology is the absence of local to global constructions; unlike the mirror complex side, where coherent sheaves are defined precisely as local objects, so that one can restrict objects from a variety to a subvariety. I will explain how one can construct a mirror "restriction functor" in some special examples of the Fukaya category.

Differential Equations
Thursday, October 16, 4:10-5:00pm
4088 EH

Monica Visan (U Chicago)
Nonlinear Schrodinger equations at critical regularity

We introduce the nonlinear Schrodinger equation (NLS) and define criticality. We then survey the history of the two most studied cases of critical NLS, namely, the mass-critical NLS and the energy-critical NLS. This includes recent joint work with Rowan Killip, Terry Tao and Xiaoyi Zhang.

Math Club
Thursday, October 16, 4:10-5:00pm
2nd floor Nesbitt Common Room
Katharine Walker (UM)
Brouwer's Fixed Point Theorem

One of the most useful theorems in mathematics is an amazing topological result known as the Brouwer Fixed-Point Theorem. Take two sheets of paper, one lying directly above the other. If you crumple the top sheet, and place it on top of the other sheet, then Brouwer's theorem says that there must be at least one point on the top sheet that is directly above the corresponding point on the bottom sheet! More formally the theorem says that a continuous function from an N -ball into an N -ball must have a fixed point. We will prove this for $N=2$.

RTG Study Seminar
Thursday, October 16, 4:10-6:00pm
3866 EH
Lars Lauder (UM)
A topological characterization of hyperbolic groups (After Bowditch)

A nonelementary word hyperbolic group G acts by homeomorphisms on its boundary, a perfect, metrisable compactum. The associated action on the space of distinct triples in the boundary is properly discontinuous and cocompact. I will give a proof, due to Bowditch, of the converse: If G acts properly discontinuously and cocompactly on the space of distinct triples of a perfect metrisable compactum, then G is actually hyperbolic.

Financial/Actuarial Mathematics Seminar (Non-standard Day)
Friday, October 17, 3:10-4:00pm
3088 EH
Paolo Guasoni (Boston University)
Portfolios and Risk Premia for the Long Run

This paper develops a method to derive optimal portfolios and risk premia explicitly in a general diffusion model, for an investor with power utility and in the limit of a long horizon. The market has several risky assets and is potentially incomplete. Investment opportunities are driven by, and partially correlated with, state variables which follow an autonomous diffusion. The framework nests models of stochastic interest rates, return predictability, stochastic volatility and correlation risk. In models with several assets and a single state variable, long-run portfolios and risk premia admit explicit formulas up the solution of an ordinary differential equation, which characterizes the principal eigenvalue of a elliptic operator. Multiple state variables lead to a partial differential equation, which is solvable for most models of interest. For each value of the relative risk aversion parameter, the paper derives the long-run portfolio, its implied risk premia and pricing measure, and their performance on a finite horizon. Two applications to cross-sectional models with predictability, stochastic volatility and stochastic interest rates conclude.

Applied and Interdisciplinary Mathematics Seminar

Friday, October 17, 3:10-4:00pm

1084 EH

Joseph Fehribach (Worcester Polytechnic Inst)

Vector Space Methods for Reaction Networks and Kirchhoff Graphs

Reaction networks are systems of chemical, electrochemical or biological reaction steps together with their constituent species. This talk will focus on the use of basic linear algebra results to determine what (if any) overall reactions can result from a given reaction network. The talk will then discuss the existence and construction of Kirchhoff graphs (reaction route graphs) associated with the reaction networks. Kirchhoff graphs satisfy the Kirchhoff laws and allow one to study a reaction network as one might use a circuit diagram to study an electrical network. There will be a number of illustrative examples.

Combinatorics

Friday, October 17, 4:10-5:00pm

3866 EH

Alexander Barvinok (UM)

On 0 – 1 matrices with prescribed row and column sums

Matrices with 0-1 entries and prescribed row and column sums is a classical object in combinatorics. In this talk, I'll present a new (and only) asymptotic formula for the number of such matrices and describe what a random 0-1 matrix with prescribed row and column sums looks like. Depending on the wishes of the audience, I can either sketch a proof or describe what changes if instead of 0-1 matrices we consider non-negative integer matrices.