

Fall 2007
University of Michigan-Department of Mathematics
<http://www.math.lsa.umich.edu/seminars/index.shtml>
Ann Arbor, MI 48109-1043

September 17th – September 23rd

Monday, September 17

- 3:10-4:00pm **Student Analysis Seminar** --- Nina White (UM) *Hausdorff Dimension* --- 3866 EH
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Skip Garibaldi (Emory U)
Bilinear forms invariant under algebraic groups --- 4096 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Debraj Chakrabarti (U of Western Ontario)
Holomorphic Extension of CR functions from Quadratic Cones --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- Aleksey Zinger (StoneyBrook) *The Geometry of Genus-One
Gromov-Witten Invariants and Mirror Symmetry* --- 4088 EH

Tuesday, September 18

- 2:10-3:00pm **"What is ... " Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Brett Parker (MIT) *Holomorphic curves, adiabatic limits and the
exploded category* --- 4088 EH
4:10-5:00pm **Colloquium** --- Yves Benoist (Ecole Normale Superieure, Paris) *Rational points on
symmetric varieties* --- 1360 EH
5:00-6:00pm **Social Hour** --- Upper Atrium

Wednesday, September 19

- 3:10-4:00pm **Student Arithmetic Seminar** --- Craig Spencer (UM) *TBA* --- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- Selim Esedoglu (UM) & Anna Gilbert (UM) *Internships in
Industry* --- 3096 EH
3:10-4:00pm **Geometric Function Theory Seminar** --- Roger W. Barnard (Texas Tech) *How far can
you deform a disk under a convex map?* --- 4096 EH
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- John
Erik Fornæss (UM) *Short \mathbb{C}^2* --- 4088 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Carl Miller (UM) *F-crystals on characteristic-p curves --
-* 3088 EH

Thursday, September 20

- 12:00-1:00pm **Mathematical Biology** --- Richard Yamada (UM) *A Chemical Kinetic Model of
Transcriptional Elongation* --- 4096 EH
2:10-3:00pm **Student Algebraic Geometry Seminar** --- Eugene Eisenstein (UM) *Bend & Break* ---
3866 EH
3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Tor, Ext, and local cohomology
... continued* --- 3096 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Hao Xing (UM) *Pricing Asian options for
jump diffusions* --- 3088 EH
3:10-4:00pm **Topology Seminar** --- José Gómez (UM) *Higher Twistings in K-theory* --- 4096 EH
3:10-5:00pm **Study Seminar** --- Mario Bonk (UM) *The mapping class group* --- 4088 EH
4:10-5:00pm **Differential Equations** --- Peter Miller (UM) *The Semiclassical Modified Nonlinear
Schrödinger Equation: Facts and Artifacts* --- 4096 EH
4:10-5:00pm **Math Club** --- Renzo Cavalieri (UM) *When points want to smash together but we don't let
them... --- 2nd Floor Nesbitt Room*
4:10-5:00pm **Student Combinatorics** --- Kelli Talaska (UM) *Young Tableaux and the Littlewood-
Richardson Rule* --- 3866 EH

Friday, September 21

- 10:50-12:00pm **EECS Theory Seminar** --- TBA --- CSE 3941

- 3:10-4:00pm **Complex Analysis Seminar** --- Roger Barnard (Texas Tech U and UM) *An isoperimetric inequality for logarithmic capacity* --- 4088 EH
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Andrew Belmonte (Penn State) *Acoustic ripples on long entrained bubbles* ---1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- Diane Vavrichek (UM) *Stallings' Theorem* --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Hannah Markwig (UM) *Counting plane elliptic tropical curves with fixed j -invariant* --- 3866 EH

UPCOMING EVENTS

Ziwet Lecture
Feb. 5, 2008
Speaker: Curtis McMullen

Rainich Lecture
Mar. 18, 2008
Speaker: Gang Tian

ABSTRACTS FOR THE WEEK OF SEPT. 17 – SEPT. 23, 2007

Student Analysis Seminar
Monday, Sept. 17, 3:10-4:00pm
3866 EH
Nina White (UM)
Hausdorff Dimension

What is dimension? We are used to thinking of dimension of a space as being a natural number. In the case of dimension of a vector space, or even topological dimension, this is true. Hausdorff dimension is a notion of dimension which corresponds to topological dimension in well-behaved spaces like Euclidean space, but takes fractional values in crazier fractal spaces. In this talk we'll define Hausdorff measure, Hausdorff dimension, and make some explicit calculations. I'll assume a basic knowledge of measure theory.

Number Theory and Representation Theory Seminar
Monday, Sept. 17, 3:10-5:00pm
4096 EH
Skip Garibaldi (Emory U)
Bilinear forms invariant under algebraic groups

For representations of semisimple Lie algebras over the complex numbers, there is a well-known criterion in terms of highest weights for whether the representation has a symmetric bilinear form that is invariant under the action of the Lie algebra, i.e., whether the representation is orthogonal. If it is, then the bilinear form is uniquely determined up to a scalar. These results are easily extended to irreducible representations of semisimple algebraic groups over arbitrary fields. For non-split groups, the bilinear form gives some information about the group. One famous example is the Killing form for simple Lie algebras over the real numbers.

It turns out that these invariant forms are already interesting for groups of type A_1 .

Several Complex Variables Seminar
Monday, September 17, 4:10-5:00pm
3096 EH
Debraj Chakrabarti (U of Western Ontario)
Holomorphic Extension of CR functions from Quadratic Cones

We consider holomorphic extension properties of CR functions defined on real submanifolds with singularities. It is proved that for a quadratic cone M , a CR function admits one-sided extension iff it does not have two sided support, a geometric condition that generalizes minimality in the sense of Tumanov.

Geometry & Physics
Monday, September 17, 4:10-6:00pm
4088 EH
Aleksey Zinger (StoneyBrook)
The Geometry of Genus-One Gromov-Witten Invariants and Mirror Symmetry

The mirror symmetry principle of string theory has led to astounding predictions for counts of holomorphic curves. The verification of the original 1991 prediction for genus-0 GW-invariants of a quintic threefold (Q3) in the mid 1990s was quickly followed by proofs of MS formulas for genus-0 invariants of other manifolds. On the other hand, the 1993 genus-1 BCOV prediction for Q3 (and other positive-genus MS formulas) remained elusive until recently. I will describe geometric properties of genus-1 invariants that make them about as computable as genus-0 invariants. In particular, they lead to the proof of the genus-1 BCOV prediction for Q3, by applying the classical localization theorem. The first hour will consist of a general overview of everything involved, except for the localization part. In the second hour, I am planning to discuss the localization computation, which in a sense is a reduction to genus 0, but I'd be happy to talk about details of any of the geometric properties if this is preferred by the audience.

Geometry Seminar
Tuesday, September 18, 3:10-4:00pm
4088 EH

Brett Parker (MIT)
Holomorphic curves, adiabatic limits and the exploded category

The exploded category is an extension of the smooth category with a good holomorphic curve theory in which some 'degenerations' appear in smooth families. I will explain how this is useful for the study of (pseudo)holomorphic curves, and the relationship between the exploded category and tropical geometry.

Colloquium
Tuesday, September 18, 4:10-5:00pm
1360 EH

Yves Benoist (Ecole Normale Superieure, Paris)
Rational points on symmetric varieties

I will describe the polar decomposition of symmetric spaces both over the real and the p-adic fields. I will explain how such a decomposition allows one to prove equidistribution results for the rational points on symmetric varieties.

Student AIM Seminar
Wednesday, September 19, 3:10-4:00pm
3096 EH

Selim Esedoglu (UM) & Anna Gilbert (UM)
Internships in Industry

At this week's meeting, Profs. Selim Esedoglu and Anna Gilbert will talk about internships: how to find them, how to get involved, and what to expect from them. Several students will give short presentations on their internship experiences this past summer. All math graduate students are welcome (both pure and applied).

Geometric Function Theory Seminar
Wednesday, September 19, 3:10-:00pm
4096 EH

Roger W. Barnard (Texas Tech)
How far can you deform a disk under a convex map?

In this talk we discuss how we apply variational techniques and special function theory to verify some conjectures of C. Pommerenke's and of D. Minda on the sharp upper bound for the Schwarzian derivative of hyperbolically convex maps. This completes the classification of the extremal domains for the Schwarzian in all three classical geometries hence answering the question first posed in the 50's as to how far one can distort a disk under a convex map in Euclidean, spherical and hyperbolic geometries.

Working Seminar in Several Complex Variables and Complex Dynamics

Wednesday, September 19, 4:10-5:30pm

4088 EH

John Erik Fornaess (UM)

Short \mathbb{C}^2

We construct domains in \mathbb{C}^2 which have some characteristic features of \mathbb{C}^2 , but who nevertheless are not biholomorphic to \mathbb{C}^2 .

Student Algebraic Geometry Seminar

Thursday, September 20, 2:10-3:00pm

3866 EH

Eugene Eisenstein (UM)

Bend & Break

Mori's bend and break techniques are a collection of lemmas that all revolve around a simple and very geometric idea: a curve that bends with some appropriate number of points fixed must, in the limit, break off into a rational component and some other curves. This talk will explain some of the reasons the lemmas are important and prove a few of them. Next week, we will apply these lemmas to show that Fano varieties have a rational curve through every point. Time permitting, I will outline the proof that Fano varieties are rationally connected (there is a rational curve through any two points).

Commutative Algebra Seminar

Thursday, September 20, 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.

Financial/Actuarial Mathematics Seminar

Thursday, September 20, 3:10-4:00pm

3088 EH

Hao Xing (UM)

Pricing Asian options for jump diffusions

In this talk, I will discuss the pricing problem for the European Asian options in jump diffusion models. Following the method which Prof. Bayraktar used to solve the problem for American options, a sequence of functions are also constructed to approximate the price of Asian options. However, because the pay-off functions are not necessarily bounded, new methods are introduced to prove the regularity of functions in this sequence. As a result, this sequence of functions converge uniformly and exponentially fast to the price of Asian option on compact sets. This provides us a fast numerical algorithm. At the end of this talk, I will present the numerical performance of this algorithm for Merton's model and Kou's model. This is a joint work with Erhan Bayraktar.

Topology Seminar
Thursday, September 20, 3:10-4:00pm
4096 EH
José Gómez (UM)
Higher Twistings in K-theory

In this talk I will discuss the so-called higher twistings for twisted K-theory.

It is known that for a compact space X , twistings of K-theory over X are classified by $[X, BGL_1(K)]$. Here $GL_1(K) \cong \mathbb{Z}/2 \times K(\mathbb{Z}, 2) \times BSU^0$ is the space of units of K with H-space structure induced by the tensor product of vector bundles. The twistings corresponding to the factor $[X, BSU^0]$ are called higher twistings. In the talk I will give a definition for the most general twistings of K-theory. This has been worked out rigorously on the literature only for the lower twistings and only sketched for the general situation.

The idea of the construction is to consider a category consisting of Fredholm operators for different Hilbert space to get a semigroup.

I will also discuss the equivariant setting limited to the case over a point. I will show that if G is a compact Lie group, then there are no higher twistings for completed twisted G -equivariant K-theory over a point. In contrast; one can see that this is not the case for topological groups in general.

Study Seminar
Thursday, September 20, 3:10-5:00pm
4088 EH
Mario Bonk (UM)
The mapping class group

Let S be a smooth closed simply connected 2-manifold. By definition the mapping class group of S is the quotient $M(S) = \text{Homeo}^+(S)/\text{Homeo}_0(S)$, where $\text{Homeo}^+(S)$ is the group of all orientation preserving homeomorphisms on S and $\text{Homeo}_0(S)$ is the group of all homeomorphisms on S isotopic to the identity. This talk is the first of a lecture series that will provide an introduction to this subject.

Differential Equations
Thursday, September 20, 4:10-5:00pm
4096 EH
Peter Miller (UM)

The Semiclassical Modified Nonlinear Schrödinger Equation: Facts and Artifacts

I will discuss some recent work (joint with J. DiFranco) on semiclassical Cauchy problems for an integrable perturbation of the focusing nonlinear Schrödinger equation. The perturbation is singular in the sense of inverse-scattering and also in the more practical sense that the modified equation admits solutions with surprisingly different properties than the unmodified equation. "Facts and Artifacts" is a reference to a similarly-titled paper by E. V. Doktorov, whose lecture on the subject in Edinburgh in 2004 originally piqued our interest.

Math Club
Thursday, September 20, 4:10-5:00pm
2nd Floor Nesbitt Room
Renzo Cavalieri (UM)

When points want to smash together but we don't let them...

In this talk we will explore a few ideas about moduli spaces (i.e., spaces X whose points naturally parameterize geometrical objects such as circles in the plane, lines in 3-space, etc.). This means two things: (i) there is a (natural) bijection between the points of X and the objects we wish to study, (ii) "close" points parameterize "similar" objects.

Our toy example will be the space of configurations of n points on the sphere. We will explicitly investigate and describe this space, and then see that it has unpleasant properties: full of holes, rips, and tears! To patch the situation (literally!) we are confronted with a fundamental problem in moduli space theory, namely how to meaningfully enlarge the class of objects being parameterized so as to obtain a more beautiful (and useful!) moduli space.

Student Combinatorics
Thursday, September 20, 4:10-5:00pm
3866 EH
Kelli Talaska (UM)

Young Tableaux and the Littlewood-Richardson Rule

Using Young tableaux and jeu de taquin, we will give a combinatorial characterization of the Littlewood-Richardson coefficients found in representation theory and algebraic geometry. We will look at some concrete examples, and if time permits, we will discuss other combinatorial descriptions and/or variations of the Littlewood-Richardson Rule.

Complex Analysis Seminar
Friday, September 21, 3:10-4:00pm
4088 EH

Roger Barnard (Texas Tech U and UM)

An isoperimetric inequality for logarithmic capacity

We discuss our proof, using symmetrizations and variational techniques, of a sharp lower bound for the logarithmic capacity of a compact connected planar set E in terms of its area and diameter.

Our result includes as special cases Faber's inequality $\text{cap } E \geq (\text{diam } E)/4$ and Polya's inequality $\text{cap } E \geq \sqrt{\{(\text{area } E)/\pi\}}$.

This is joint work with K. Pearce and A.Y. Solynin.

Applied and Interdisciplinary Mathematics Seminar
Friday, September 21, 3:10-4:00pm
1084 EH
Andrew Belmonte (Penn State)
Acoustic ripples on long entrained bubbles

How does a rapidly moving object enter a quiescent fluid? The experimental study of this problem parallels the development of high-speed imaging (Worthington, Edgerton), and recent studies show that there are still new things to be understood - even in water. I will present our experiments on the fluid impact of a solid sphere, which produces a cavity and subsequently an entrained bubble, a splash, and an audible PLUNK! We have found that this acoustic emission leads to coherent ripples on the bubble surface, which are fixed in the lab frame, and begin just after the pinch-off ("deep seal") of the cavity. A potential flow model for a slightly compressible fluid explains these ripples as the spatial rectification of the acoustic bubble oscillations by the moving object. This is joint work with T. Grumstrup and J. B. Keller.

Student Geometry/Topology
Friday, September 21, 3:10-4:00pm
3096 EH
Diane Vavrichek (UM)
Stallings' Theorem

Stallings' Theorem is a foundational result in geometric group theory. It relates the geometry of the Cayley graph of a group to the algebraic structure of the group.

Combinatorics
Friday, September 21, 4:10-5:00pm
3866 EH
Hannah Markwig (UM)
Counting plane elliptic tropical curves with fixed j -invariant

Tropical geometry replaces algebraic varieties by certain ("tropical") degenerations, which are piecewise linear and therefore often easier to study. I will present a result that is easy to derive within tropical geometry, whereas its [proof](#) in conventional algebraic geometry is hard: the counting of plane elliptic curves with a fixed j -invariant.

This is [joint work](#) with Michael Kerber.