

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

November 5th – November 11th

Monday, November 5

- 3:10-4:00pm **Student Analysis Seminar** --- Chris Hammond (UM) *Hormander's Solution of the d -Bar Problem on Pseudoconvex Domains* --- 3866 EH
- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Karl Schwede (UM) *Boundedness of our Moduli problem part 2* --- 2866 EH
- 3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Kartik Prasanna (U of Maryland) *Algebraic cycles and exotic Heegner points* --- 4096 EH
- 4:10-5:00pm **Several Complex Variables Seminar** --- Al Taylor (UM) *Convergence of fixed point iteration for a class of matrix-valued analytic functions* --- 3096 EH
- 4:10-6:00pm **Geometry & Physics** --- Sheldon Katz (UIUC) *Deformed quantum cohomology* --- 4088 EH
- 4:30-5:30pm **Distinguished Lecture in Computer Science and Engineering** --- Daniel Spielman (Yale) *Smoothed Analysis of Algorithms* --- 1670 CSE
- 5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

Tuesday, November 6

- 2:10-3:00pm **"What is ... " Seminar** --- John Roe (Penn State U) *What is ... Property A?* --- 3096 EH
- 3:10-4:00pm **Geometry Seminar** --- TBA --- 4088 EH
- 3:10-4:00pm **Algebra Seminar** --- Benjamin Howard (UM) *Degree bounds for the generators of the ring of projective invariants of n points in projective space and the semigroup algebra of Gelfand Tsetlin patterns* --- 3088 EH
- 3:10-4:00pm **Student Representation Theory/Lie Theory Seminar** --- Nina White (UM) *Representations of Finite Groups, Part II: Characters* --- 4096 EH
- 4:10-5:00pm **Colloquium** --- John Roe (Penn State U) *Large scale index theory* --- 1360 EH

Wednesday, November 7

- 3:10-5:00pm **Geometric Function Theory Seminar** --- Not meeting this week --- 4096 EH
- 3:10-4:00pm **Student Arithmetic Seminar** --- Ben Weiss (UM) *Mahler Measure, part 1* --- 3866 EH
- 3:10-4:00pm **Student AIM Seminar** --- Lei Wang (UM) *Investigation of Treecode in Fast Evaluation of Multiquadric Radial Basis Function* --- 3096 EH
- 3:10-4:00pm **Working Group in Integrable Systems and Asymptotics** --- Zhengjie Xu (UM) *Inverse scattering method for the three-wave interaction equations, II* --- 4088 EH
- 4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Liz Vivas (UM) *A long \mathbb{C}^2 which is not Stein* --- 4088 EH
- 4:10-6:00pm **Algebraic Geometry Seminar** --- Jenia Tevelev (U. Mass) *Tropical compactifications of subvarieties of tori* --- 3088 EH

Thursday, November 8

- 2:10-3:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3866 EH
- 2:10-3:00pm **Study Seminar (Pt. 1)** --- Daniel Meyer (UM) *The Douady-Earle extension II* --- 3096 EH
- 3:10-4:00pm **Study Seminar (Pt. 2)** --- Daniel Meyer (UM) *The Douady-Earle extension II (cont.)* --- 4088 EH
- 3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Mark O'Reilly (Deloitte Consulting LLP, Detroit) *Sticky Luck: Why Patterns Persist in an Efficient Market, and Why They Never Change Our Expected Return* --- 3088 EH

Thursday, November 8 ... 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** --- Ciprian Manolescu (Columbia U) *Combinatorial Floer homology* --
- 4096 EH
- 4:10-5:00pm **Differential Equations** --- Blake Temple (UC Davis) *Time-Periodic Solutions Of The Compressible Euler Equations, Part II* --- 4088 EH
- 4:10-5:00pm **Math Club** --- Marie Snipes (UM) *Takeya's problem: rotating needles in the plane* --- 2nd
Floor Nesbitt Room
- 4:10-5:00pm **Student Combinatorics** --- Austin Shapiro (UM) *Monomial Ideals II* --- 3866 EH
- 4:10-5:00pm **Applied and Interdisciplinary Mathematics Seminar (Special Seminar)** --- John C. Schotland (U of Penn) *Optical tomography* --- 1311 EECS

Friday, November 9

- 10:50-12:00pm **EECS Theory Seminar** --- Brian Wyman (UM) TBA --- CSE 3941
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Ted Bergin (UM)
The origin of water on the earth ---1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- TBA --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Alexander Gamburd (UCSC/IAS) *Expanders: from arithmetic to combinatorics and back* --- 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. 5 – NOV. 11, 2007

Student Analysis Seminar
Monday, November 5, 3:10-4:00pm
3866 EH
Chris Hammond (UM)
Hormander's Solution of the d-Bar Problem on Pseudoconvex Domains

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.

Topics in Algebraic Geometry Seminar
Monday, November 5, 3:10-4:00pm
2866 EH
Karl Schwede (UM)
Boundedness of our Moduli problem part 2

We've now talked about the classes of singularities we want let "join the party". I will talk about boundedness for this new moduli problem.

Number Theory and Representation Theory Seminar
Monday, November 5, 3:10-5:00pm
4096 EH
Kartik Prasanna (U of Maryland)
Algebraic cycles and exotic Heegner points

I will describe a new (conjectural) construction of rational points on CM elliptic curves using cycles on higher dimensional varieties. This will be a report on work in progress with Massimo Bertolini and Henri Darmon..

Several Complex Variables Seminar
Monday, November 5, 4:10-5:00pm
3096 EH
Al Taylor (UM)
Convergence of fixed point iteration for a class of matrix-valued analytic functions

In the study of discrete random walks on strips, one solution of the matrix equation $G = a(G)$ encodes important information about the long term behavior of the walk. Here, the function $a(z)$ is an $m \times m$ matrix valued analytic function in the unit disk. For the functions $a(z)$ that come from random walks, it is easy to see that the solution G that contains probabilistic information is obtained by making the initial estimate, $G_0 = 0$ and then taking the limit using the fixed point iteration $G \rightarrow a(G)$. We will explain what happens in general for this fixed point iteration, at least for the $a(z)$ that come from random walks. The results suggest several open problems about the iteration of maps on the space of matrices with spectral radius smaller than one.

Geometry & Physics
Monday, November 5, 4:10-6:00pm
4088 EH
Sheldon Katz (UIUC)
Deformed quantum cohomology

A generalization of quantum cohomology is suggested by half-twisting $(0,2)$ models in string theory. The input data is a compact Kahler manifold M and a vector bundle E satisfying $c_i(E) = c_i(M)$ for $i=1,2$. If E is the tangent bundle of M , ordinary quantum cohomology results. The talk will review quantum cohomology, explain what is known and what is not known about this suggested generalization of quantum cohomology, and give a glimpse into the physical origins. The main examples will be when E is a deformation of the tangent bundle, resulting in a Frobenius algebra depending on the deformation parameters which deform the usual quantum cohomology ring. This talk is based on joint works with Eric Sharpe and Josh Guffin.

Distinguished Lecture in Computer Science and Engineering
Monday, November 5, 4:30-5:30pm
1670 CSE
Daniel Spielman (Yale)
Smoothed Analysis of Algorithms

Theorists have long been challenged by the existence of remarkable algorithms that are known by scientists and engineers to work well in practice, but whose theoretical analyses have been negative or unconvincing. The root of the problem is that algorithms are usually analyzed in one of two ways: by worst-case or average-case analysis. The former can improperly suggest that an algorithm will perform poorly, while the latter can be unconvincing because the random inputs it considers may fail to resemble those encountered in practice. We present a new approach called smoothed analysis that can help explain the success of many algorithms that both worst-case and average-case analyses cannot. In smoothed analysis, we measure the performance of an algorithm under slight random perturbations of arbitrary inputs, and bound the performance as a function of the size of the input and the magnitude of the perturbation. If an algorithm has low smoothed complexity, then it should perform well if its inputs are subject to random noise. We will explain how smoothed analysis has been used to analyze the behavior of many algorithms and heuristics, including the simplex algorithm, Gaussian elimination with partial pivoting, and k-means.

“What is ...” Seminar
Tuesday, November 6, 2:10-3:00pm
3096 EH
John Roe (Penn State U)
What is ... Property A?

A discrete finitely generated group carries a natural equivalence class of metrics. Amazingly, the metric structure by itself is enough to carry out a bit of harmonic analysis. The notion of Property A for metric spaces was invented about ten years ago and is natural in this context. I'll explain what it is, give some examples, and show how it can be used.

Algebra Seminar
Tuesday, November 6, 3:10-4:00pm
3088 EH
Benjamin Howard (UM)
Degree bounds for the generators of the ring of projective invariants of n points in projective space and the semigroup algebra of Gelfand Tsetlin patterns

Fix a positive integer n , and let R_n denote the coordinate ring of the geometric invariant theory quotient $(\mathbb{P}^2)^n // SL_3$, using the line bundle $\mathcal{O}(1, 1, 1, \dots, 1)$ on $(\mathbb{P}^2)^n$. Using some facts about matroids and a theorem of Harm Derksen, we find an upper bound for the maximal degree among a minimal set of generators for R_n which is on the order of n^2 . We do not expect this bound to be sharp.

We contrast this with the complexity of a related algebra S_n , the semigroup algebra of Gelfand Tsetlin patterns of a particular shape and content. The semigroup algebra S_n is the associated graded algebra of an \mathbb{N} -filtration of R_n .

We find a lower bound for the maximal degree of a minimal set of generators for S_n is approximately $n^{2/2}$. This is joint work with Tyrrell McAllister.

Student Representation Theory/Lie Theory Seminar
Tuesday, November 6, 3:10-4:00pm
4096 EH
Nina White (UM)
Representations of Finite Groups, Part II: Characters

We'll define the character of a representation and how representations are determined by their characters. We'll prove and use computational facts about characters in order to construct character tables of some finite groups. We'll use these tables to find all representations of those groups. This will be a very introductory talk, covering roughly Chapter 2 of Fulton and Harris (Chapter 1 was covered last week).

Colloquium
Tuesday, November 6, 4:10-5:00pm
1360 EH
John Roe (Penn State U)
Large scale index theory

The Atiyah Singer index theorem relates analysis and topology through the crucial notion of the Fredholm index of an elliptic operator (this is basically linear algebra: the difference between how much existence and how much uniqueness there is for solutions of a given equation). In this talk I will explain how forming the index can be viewed as a process of coarsening forgetting small scale structure. This leads to new versions of the index theorem on spaces that lack the compactness property necessary for the usual elliptic/Fredholm theory. The talk will be accessible to graduate students.

Student Arithmetic Seminar
Wednesday, November 7, 3:10-4:00pm
3866 EH
Ben Weiss (UM)
Mahler Measure, part 1

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 7, 3:10-4:00pm
3096 EH
Lei Wang (UM)

Investigation of Treecode in Fast Evaluation of Multiquadric Radial Basis Function

Multiquadrics are a popular choice of radial basis function for interpolating scattered data in one or more dimensions. Unfortunately, the adoption of multiquadrics for real problems with large data sets has been hindered by a perceived large computational cost. Indeed, the direct evaluation of an N center multiquadric radial basis function at m points requires $O(mN)$ flops, which is prohibitive when m and N are large. However, the use of treecode and some other methods allow fast evaluation and fitting of radial basis function. We are investigating and comparing some different far field expansions and data structures of treecode.

Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, November 7, 4:10-5:30pm
4088 EH
Liz Vivas (UM)

A long \mathbb{C}^2 which is not Stein

We will look at recent work of Erlend Wold. In this paper the author answers a question posed by Fornæss and Sibony: Is any long \mathbb{C}^2 biholomorphic to \mathbb{C}^2 ? A complex manifold is a long \mathbb{C}^2 if it is a union of proper subsets which are biholomorphic to \mathbb{C}^2 . The answer is negative and the author constructs a long \mathbb{C}^2 which is not Stein.

Study Seminar (Pt. 1) & (Pt. 2)
Thursday, November 8, (Pt. 1) 2:10-3:00 & (Pt. 2) 3:10-4:00
(Pt. 1) 3096 EH & (Pt. 2) 4088 EH
Daniel Meyer (UM)
The Douady-Earle extension II

Let f be a quasisymmetric map from the unit circle to itself. Douady-Earle have constructed an extension F of this map to the closed unit disk. It is natural in the following sense. Let h be a Moebius transformation of the unit disk. Then the extension of $h \circ f$ is given by $h \circ F$. (continued)

Commutative Algebra Seminar
Thursday, November 8, 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.

Differential Equations
Thursday, November 8, 4:10-5:00pm
4088 EH

Blake Temple (UC Davis)

Time-Periodic Solutions Of The Compressible Euler Equations, Part II

I discuss a current program with Robin Young to construct time-periodic solutions of the compressible Euler equations. I will present our derivation of the simplest possible wave pattern consistent with periodic evolution, the realization of solutions with this structure at a linearized level, and the progress of our program to prove that solutions of the linearized equation perturb to exact solutions of the nonlinear equations. Such solutions would describe new shock-free waves that propagate through an oscillating entropy field without breaking or dissipating, and transmit information according to a new mechanism. In particular, the waves propagate at a new speed, (different from a shock or sound speed), and sound waves move through periods at speeds that can be commensurate or incommensurate with the period. The period determines the speed of the wave crests, (a sort of observable group velocity), but the sound waves move at a faster speed, the usual speed of sound, and this is like a phase velocity. The mathematical issues in the perturbation problem involve resonances and small divisors analogous to those that arise in KAM theory. The construction and proof of the existence of nonlinear time periodic solutions of the compressible Euler equations is an open problem that dates to the time of Euler.

Math Club

Thursday, November 8, 4:10-5:00pm
2nd Floor Nesbitt Room

Marie Snipes (UM)

Keakeya's problem: rotating needles in the plane

Given a needle lying on a table, what is the smallest area in which you can turn the needle around without lifting it off the table? Clearly, you can just rotate the needle around its center of mass, but can you do better? It was conjectured by Keakeya in the early 20th century that a 3-pointed deltoid (which is not convex) achieves the minimal possible area, but to everyone's astonishment Besicovitch showed a few years later that this was spectacularly wrong: if your table is large enough, you can turn the needle around in a set of arbitrarily small area! Not only is this a surprising and fun fact to prove, but perhaps more remarkably it has many interesting applications to a diverse array of problems in mathematics, some of which will be discussed.

Applied and Interdisciplinary Mathematics Seminar (Special Seminar)

Thursday, November 8, 4:10-5:00pm
1311 EECS

John C. Schotland (U of Penn)

Optical tomography

There is considerable interest in the development of optical methods for biomedical imaging. The physical problem consists of recovering the optical properties of a medium probed by multiply-scattered light. This talk will review recent work on related inverse scattering problems for the radiative transport equation and fast image reconstruction algorithms for large data sets. Numerical simulations and experimental data from model systems will be used to illustrate the results.

Applied and Interdisciplinary Mathematics Seminar
Friday, November 9, 3:00-4:00pm
1084 EH
Ted Bergin (UM)
The origin of water on the earth

In a few key instances the chemical composition of meteorites and comets provides a fossil record of the physical conditions present at their creation. In this talk I will explore a new line of evidence that links the chemistry of the solar nebula (the cloud of gas and dust that collapsed to form our solar system) to that seen in interstellar space today. In particular, I will discuss new work on the abundance of water vapor and ice in molecular clouds and link this to the origin of oxygen isotopic anomalies seen in primitive meteorites. I will show how this also implies that the Sun did not form in isolation, but rather was formed in a cluster of stars.

Combinatorics
Friday, November 9, 4:10-5:00pm
3866 EH
Alexander Gamburd (UCSC/IAS)
Expanders: from arithmetics to combinatorics and back

Expanders are highly-connected sparse graphs widely used in computer science. The optimal expanders (Ramanujan graphs) were constructed in 1988 by Margulis, Lubotzky, Phillips and Sarnak using deep results from the theory of automorphic forms. In recent joint work with Bourgain and Sarnak tools from additive combinatorics were used to prove that a wide class of "congruence graphs" are expanders; this expansion property plays a crucial role in establishing novel sieving results.