Winter 2009
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
March 2nd – March 8th

Monday, March 2

3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Amanda Knecht (UM) *Numerical Criterion for GIT* --- 2866 EH
3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- Aaron Levin (Scuola Normale Superiore, Pisa) *Integral points on higher-dimensional varieties* --- 4096 EH
4:10-5:00pm **Student Combinatorics** --- Dave Anderson (UM) *Random Graphs* --- 3866 EH
4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- TBA --- 3096 EH
4:10-6:00pm **Geometry and Physics Seminar** --- Matilde Marcolli (Caltech) *Feynman integrals and algebraic geometry* --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3096 EH

Tuesday, March 3

2:10-3:00pm "**What is … " Seminar** --- Martin Strauss (UM) *What is … a Probabilistically-Checkable Proof?* --- 3096 EH
3:10-4:00pm **Algebra Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Tom Church (U Chicago) *Groups of mapping classes that cannot be realized by diffeomorphisms* --- 3866 EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- Jose Gonzalez (UM) *The cone theorem: a multiplier ideal perspective* --- 3088 EH
3:10-4:00pm **Student Seminar in Complex Dynamical Systems** --- TBA --- 4088 EH
4:10-5:00pm **Colloquium ---** Matilde Marcolli (Caltech) **--** *Noncommutative geometry and the field with one element* **---** 1360 EH
4:10-5:00pm **Student AIM Seminar** --- TBA --- 3088 EH

Wednesday, March 4

3:10-4:00pm **Geometric Function Theory Seminar** --- TBA--- 4096 EH
3:10-4:00pm **Student Representation Theory Seminar** --- Ricardo Portilla (UM) --- *TBD* --- 3096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- Zachary Scherr (UM) *On the size of Kakeya sets in finite fields* --- 3088 EH
4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Chris Hammond (UM) *The Isoperimetric Problem for Fefferman Hypersurface Measure* --- 3096 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Mircea Mustata (UM) --- TBD **---** 3088 EH

Thursday, March 5

3:10-4:00pm **Commutative Algebra Seminar** --- Not meeting this week --- 3096 EH
3:10-4:00pm **Topology Seminar** --- Jessica Purcell (Brigham Young) – *Hyperbolic structures on compression bodies* --- 4088 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Xin Guo (Dept of Industrial Engineering and Operations Research, UC Berkeley) *Connecting singular controls and switching controls, with applications* --- 3088 EH
4:10-5:00pm **Differential Equations ---** Nicolai Krylov (Minnesota) *Second-order elliptic equations with variably partially VMO coefficients* **---** 4088 EH
4:10-5:00pm **Math Club** --- Valentina Joukhovitski (UM) *Topology of links and knots (or, how I learned to enjoy math)* --- 2nd floor Nesbitt Common Room
4:10-6:00pm **RTG Study Seminar** --- TBA --- 3866 EH

Friday, March 6

11:10-12:00pm **Theoretical Computer Science Seminar** --- Xiaodi Wu (UM) --- The *Geometry of Binary Search Trees* --- CSE 4941

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- H. N. Mhaskar (Cal State) *Analysis of local features of a function using spectral and scattered data* --- 1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Marshall Williams (UM) --- TBA --- 3096 E

4:10-5:00pm **Combinatorics** --- John Stembridge (UM) *Admissible W-graphs and commuting Cartan matrices* --- 3866 EH

UPCOMING EVENTS

Graduate Recruitment Weekend
March 20 - March 22, 2009

Departmental External Review
March 22-24, 2009

RTG Workshop on SCV and Geometry
April 10 - April 12, 2009

ABSTRACTS FOR THE WEEK OF MARCH 2 – MARCH 8, 2009

Group Theory/Lie Theory/Number Theory Seminar
Monday, March 2, 3:10-5:00pm
4096 EH
Aaron Levin (Scuola Normale Superiore, Pisa)
Integral points on higher-dimensional varieties

After introducing and reviewing the situation for rational and integral points on curves, I will discuss various aspects of integral points on higher-dimensional varieties. In addition to discussing recent higher-dimensional results, I will also touch on connections with the value distribution theory of holomorphic functions and give some concrete open problems.

Student Combinatorics
Monday, March 2, 4:10-5:00pm
3866 EH
Dave Anderson (UM)
Random Graphs

Suppose you build a graph on n vertices by connecting two vertices with uniform probability p. As n grows, how big is the largest connected component of the graph? This question was considered (and answered) by Erdos and Renyi in 1959. I'll discuss this and related constructions; the talk might be accessible to high school students.

Geometry and Physics Seminar
Monday, March 2, 4:10-6:00pm
4088 EH
Matilde Marcolli (Caltech)
Feynman integrals and algebraic geometry

Computational evidence suggests that residues of Feynman integrals in perturbative quantum field theory should be periods of mixed Tate motives. There are two concurring approaches to understand this mysterious relation between quantum fields and motives: a top-down approach based on comparing Tannakian category (based on my earlier joint work with Connes) and a bottom-up approach developed by Bloch-Esnault-Kreimer based on algebraic varieties (graph hypersurfaces) associated to the parametric form of Feynman integrals. I will introduce both approaches and then focus on recent joint work with Aluffi on the motives of graph hypersurfaces.

"What is … " Seminar
Tuesday, March 3, 2:10-3:00pm
3096 EH
Martin Strauss (UM)
What is … a Probabilistically-Checkable Proof?

In a probabilistically-checkable proof system, a verifier checks a small number of randomly-chosen bits in a "proof" and, with high probability, determines properly whether the "proof" is valid or not.
We survey connections and applications to error-correcting codes, to inapproximability (there are functions that cannot be computed or even approximated efficiently), and to zero-knowledge (Alice convinces Bob that a theorem is true without giving Bob any help in proving that theorem). We consider cultural applications to the proofs of Tartaglia, Appel and Haken, and Auburn.

Geometry Seminar
Tuesday, March 3, 3:10-4:00pm
3866 EH
Tom Church (U Chicago)
Groups of mapping classes that cannot be realized by diffeomorphisms

Groups of mapping classes that cannot be realized by di_eomorphisms Morita proved that the mapping class group cannot be realized by di_eomorphisms. The mapping class group of a surface _ with one marked point z _ts into the short exact sequence 1 ! _1(_; z) ! Map(_; z) ! Map(_) ! 1: The kernel is known as the point-pushing subgroup, since its elementsare obtained by \pushing" the marked point along loops in the fundamental group of _. By using Milnor's inequality for the Euler number of a at vector bundle over a surface, we show that the point-pushing subgroup cannot be realized by di_eomorphisms of _ _xing z. We apply this result to construct a group isomorphic to _1(_0)_Z=3Z inside Map(_) that cannot be realized by di_eomorphisms; as a corollary, this yields a new proof of Morita's theorem. I will conclude by relating this group to the branched surface bundles constructed by Atiyah and Kodaira. Joint work with Mladen Bestvina and Juan Souto.

Colloquium
Tuesday, March 3, 4:10-5:00pm
1360 EH
Matilde Marcolli (Caltech)
Noncommutative geometry and the field with one element

I will discuss the interplay between quantum statistical mechanical systems associated to certain arithmetic quotients in noncommutative geometry and some approaches to the construction of algebraic geometry over the non-existing field with one element. The lecture will be mostly based on joint work with Connes and Consani.

Student Arithmetic Seminar
Wednesday, March 4, 3:10-4:00pm
3088 EH
Zachary Scherr (UM)
On the size of Kakeya sets in finite fields

A Kakeya set was originally defined as the space through which a needle passes while turning around. Over finite fields, it is defined as a subset of affine n-space which contains a line in every direction. In this talk I will prove a recent result of Zeev Dvir, an Israeli graduate student, on lover bounds for the size of Kakeya sets. In 2008, Dvir managed to improve the best known lover bound from Omega(q^(4n/7)) to the near optimal Omega(q^n).

RTG Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, March 4, 4:10-5:00pm
3096 EH
Chris Hammond (UM)
The Isoperimetric Problem for Fefferman Hypersurface Measure

Fefferman introduced a scaled-version of surface-area measure on real hypersurfaces in $\mathbb{C}^{n}$ which is invariant under volume-preserving biholomorphisms. We derive the Euler equation for the associated isopermetric problem. We then use volume-preserving invariants to characterize the solutions. We show that under "natural" assumptions, spheres are the only solutions. If there is time, we might also discuss how the proof of the differentiability of the volume by Lazarsfeld-Mustata can be modified to yield the differentiability of the relative energy, at least in the ample cone.

Financial/Actuarial Mathematics Seminar
Thursday, March 5, 3:10-4:00pm
3088 EH
Xin Guo (Department of ORIE, UC Berkeley)
Connecting singular controls and switching controls, with applications

It was well known that a certain class of singular control problems is connected to optimal stopping problems. In this talk, we present a new theoretical connection between singular control of finite variation and optimal switching problems. This correspondence provides a novel method for solving explicitly multi-dimensional singular control problems, and links singular controls and Dynkin games through sequential optimal stopping.

Differential Equations
Thursday, March 5, 4:10-5:00pm
4088 EH
Nicolai Krylov (Minnesota)
Second-order elliptic equations with variably partially VMO coefficients

The solvability in $W^{2}_{p}(\bR^{d})$ spaces is proved for second-order elliptic equations with coefficients which are measurable in one direction and VMO in the orthogonal directions in each small ball with the direction depending on the ball. This generalizes to a very large extent the case of equations with continuous or VMO coefficients.

Math Club
Thursday, March 5, 4:10-5:00pm
2nd floor Nesbitt Common Room
Valentina Joukhovitski (UM)
Topology of links and knots (or, how I learned to enjoy math)

Ever had that frustrating experience with tangled iPod earbuds wires? It seems that no matter how careful you are as you stuff them into a pocket, the earphones always come out knotted. Is it always possible to undo the damage? We will discuss knots and some of their invariants. These will tell us whether we can untangle a knot, or not. We will start with elementary polynomial invariants and eventually will graduate to scarier sounding words.

Theoretical Computer Science Seminar
Friday, March 6, 11:10-12:00p
CSE 4941
Xiaodi Wu (UM)
The Geometry of Binary Search Trees

A novel connection binary search trees (BSTs) and points in the plane satisfying a simple property (arborally satisfied set) is found recently by E. Demanie et al (SODA09). A surprisingly clean statement in geometric terms of many results and conjectures relating to BSTs can be obtained by this new connection. Besides, new lower bounds for searching in the BST models are achieved.
This talk will mainly cover the correspondence between the BST model of computation and ASS set on the plane and the lower bounds.

Applied and Interdisciplinary Mathematics Seminar
Friday, March 6, 3:10-4:00pm
1084 EH
H. N. Mhaskar (Cal State)
Analysis of local features of a function using spectral and scattered data

It is well known that an algebraic (or trigonometric) polynomial is completely determined by its values on a small interval. Therefore, such traditional methods of function approximation as least squares fit, Fourier projection, and interpolation are unsatisfactory for approximating functions which are generally ``good'' but have a few ``bad points''. We discuss the construction of polynomials whose degree of approximation on different parts of the domain is commensurate with the local smoothness of the target function on a neighborhood of this domain. Our constructions are based on either Fourier information or values of the target function, where one has no control on the location of the points at which the function is sampled. The approximating polynomial is the same on the whole domain; only the approximation behavior changes on different parts in an almost spline-like manner. The constructions are not adaptive, and do not require an a priori knowledge about the behavior of the target function on different parts of the domain. Applications include direction finding in linear phased array antennas, and solutions of pseudo-differential equations on the sphere.

Combinatorics
Friday, March 6, 4:10-5:00pm
3866 EH
John Stembridge (UM)
Admissible W-graphs and commuting Cartan matrices

A W-graph is a weighted directed graph that encodes certain actions of a Coxeter group W or the associated Iwahori-Hecke algebra $H(W)$. It is admissible if it is bipartite and has nonnegative integer edge weights that satisfy a simple symmetry condition. Of particular interest are the admissible W-graphs and WxW-graphs that encode the one-sided and two-sided actions of the standard generators on the Kazhdan-Lusztig basis of $H(W)$, as well as the strongly connected components of these graphs---the latter are the so-called Kazhdan-Lusztig cells. In this talk, we will report on progress toward understanding the structure and classification of admissible W-graphs. An interesting recent development is the classification of all admissible W_1xW_2-cells, where W_1 and W_2 both have rank two. This amounts to classifying pairs of simply-laced Cartan matrices of the same rank that commute and satisfy a simple parity condition. It turns out that there are 5 infinite families of such Cartan pairs (up to isomorphism), as well as 8 exceptional pairs whose ranks range from 12 to 32.