Winter 2008
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
March 3rd – March 9th

Monday, March 3

3:10-4:00pm **Geometric Function Theory Seminar (Note: Unusual Day)** --- Laurent Moonens (Université Catholique de Louvain) A multi-dimensional Luzin theorem --- 3866 EH
3:10-4:00pm **Student Analysis Seminar** --- Not meeting this week --- 3866 EH
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Kyle Hofmann (UM) TBD --- 2866 EH
3:10-4:00pm **Working Group in Integrable Systems and Asymptotics** --- Zhengjie Xu (UM) *Inverse Scattering for the Benjamin-Ono Equation, V* --- 3088 EH
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Jiu-Kang Yu (Purdue) *A dyadic exercise in the construction of supercuspidal representations and types* --- 4096 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Laura DeMarco (UIC) *Polynomials, trees and valuations* --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- TBA --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

Tuesday, March 4

2:10-3:00pm "**What is … " Seminar** --- Brian Conrad (UM) *What is … a Galois representation?* --- 3096 EH
3:10-4:00pm **Algebra Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Lizhen Ji (UM) *Duality properties of arithmetic groups, mapping class groups, and outer automorphism group of free groups* --- 4088 EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH
4:10-5:00pm **Colloquium (Lectures in Algebraic Geometry, Talk I)** --- Ravi Vakil (Stanford) *Murphy's Law in algebraic geometry: Badly-behaved moduli spaces* --- 1360 EH

Wednesday, March 5

3:10-4:00pm **Student Representation Theory/Lie Theory Seminar** --- TBA --- 3088 EH
3:10-4:00pm **Student Arithmetic Seminar** --- TBA --- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- TBA --- 3096 EH
4:10-5:00pm **Complex Analysis Seminar** --- Not meeting this week --- 3096 EH
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- TBA --- 4088 EH
4:10-6:00pm **Algebraic Geometry Seminar (Lectures in Algebraic Geometry, Talk II)** --- Ravi Vakil (Stanford) *Reimagining universal covers and fundamental groups in algebraic and arithmetic geometry* --- 3088 EH

Thursday, March 6

3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Phantom homology (cont.)* --- 3096 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Semih Sezer (UM) *Finite Horizon Decision Timing with Partially Observable Poisson Processes* --- 3088 EH
3:10-4:00pm **Algebraic Geometry Seminar (Lectures in Algebraic Geometry, Talk III)** --- Ravi Vakil (Stanford) *Using branched covers of the projective line to get at the topology of the moduli space of curves* --- 4088 EH
4:10-5:00pm **Topology Seminar** --- Maryam Mirzakhani (Princeton) TBA --- 3088 EH
4:10-5:00pm **Differential Equations** --- Charlie Doering (UM) *Statistically Stationary Stirring with Steady Sources and Sink* --- 4088 EH
4:10-5:00pm **Math Club (Note: Unusual Location)** --- Jeff Lagarias (UM) *Apollonian circle packings* (Undergraduate Colloquium) --- 1360 EH
4:10-5:00pm **Student Combinatorics** --- Luis Serrano (UM) *k-Schur Functions I* --- 3866 EH

Thursday, March 6 … continued

4:10-5:30pm **Logic Seminar** --- TBA --- 3096 EH
4:10-6:00pm **Study Seminar** --- Not meeting this week --- 3088 EH

Friday, March 7

10:50-12:00pm **EECS Theory Seminar** --- TBA --- CSE 3941
2:10-3:00pm **Topics in Geometry** --- Not meeting this week --- 3866 EH
3:10-4:00pm **Algebraic Geometry Seminar (Lectures in Algebraic Geometry, Talk IV)** --- Ravi Vakil (Stanford) --- 4088 EH
3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Jing Shi (Wayne State) *Numerical Methods for Multidimensional Tunneling Transitions: A Quantum Transition State Theory* --- 1084 EH
3:10-4:00pm **Student Geometry/Topology** --- Jose Gomez (UM) TBA --- 3096 EH
4:10-5:00pm **Combinatorics** --- TBA--- 3866 EH

UPCOMING EVENTS

Graduate Student Recruitment Weekend
March 14 & 15, 2008

ABSTRACTS FOR THE WEEK OF MAR. 3– MAR. 9, 2008

Geometric Function Theory Seminar (Note: Unusual Day)
Monday, March 3, 3:10-4:00pm
3866 EH
Laurent Moonens (Université Catholique de Louvain)
A multi-dimensional Luzin theorem

In 1912, N. Luzin showed that given any measurable function $f:\RR\to\RR$, there exists a continuous, a.e. differentiable function $F:\RR\to\RR$ for which $F'(x)=f(x)$ for a.e. x in $\RR$.

G. Alberti showed in 1991 that given any $\epsilon > 0$, an open set U in $\RR^n$ with finite measure, and a measurable function $v:U\to\RR^n$, there exists a compact set K in U so that $|U\setminus K| \leq \epsilon |U|$ and a C^1-function $u:U\to\RR$ so that v is the gradient of u at each point x in K.

Starting from Alberti's result, we will show that given any measurable vector field $v:\RR^n\to\RR^n$, there exists a continuous, a.e.
differentiable function $u:\RR^n\to\RR$ so that v equals the gradient of u at almost every point x in $\RR^n$.

Several Complex Variables Seminar
Monday, March 3, 4:10-5:00pm
3096 EH
Laura DeMarco (UIC)
Polynomials, trees and valuations

The moduli space of polynomials can be compactified by a space of trees. These trees play the role (in the setting of dynamics of rational maps) of the R-trees which compactify spaces of hyperbolic structures. If there's time, I will describe some new work relating the compactification to a space of valuations. This is a joint project with Curt McMullen.

"What is … " Seminar
Tuesday, March 4, 2:10-3:00pm
3096 EH
Brian Conrad (UM)
What is … a Galois representation?

We explain how representations of Galois groups naturally arise in a variety of ways in number theory, and how they can be used to study interesting concepts whose definition does not involve Galois groups.

Geometry Seminar
Tuesday, March 4, 3:10-4:00pm
4088 EH
Lizhen Ji (UM)
Duality properties of arithmetic groups, mapping class groups, and outer automorphism group of free groups

There have been many known similarities between three natural class of groups: arithmetic subgroups of linear algebraic groups, mapping class groups, and outer automorphism groups of free groups. In this talk, I will discuss their similarities from the point of view of Poincare and generalized Poincare duality properties.

Colloquium (Lectures in Algebraic Geometry, Talk I)
Tuesday, March 4, 4:10-5:00pm
1360 EH
Ravi Vakil (Stanford University)
Murphy's Law in algebraic geometry: Badly-behaved moduli spaces

We consider the question: "How bad can the deformation space of an object be?" (Alternatively: "What singularities can appear on a moduli space?") The answer seems to be: "Unless there is some a priori reason otherwise, the deformation space can be arbitrarily bad." We show this for a number of important moduli spaces. More precisely, up to smooth parameters, every singularity that can be described by equations with integer coefficients appears on moduli spaces parameterizing: smooth projective surfaces (or higher-dimensional manifolds); smooth curves in projective space (the space of stable maps, or the Hilbert scheme); plane curves with nodes and cusps; stable sheaves; isolated threefold singularities; and more. The objects themselves are not pathological, and are in fact as nice as can be. This justifies Mumford's philosophy that even moduli spaces of well-behaved objects should be arbitrarily bad unless there is an a priori reason otherwise. I will begin by telling you what "moduli spaces" and "deformation spaces" are. The complex-minded listener can work in the holomorphic category; the arithmetic listener can think in mixed or positive characteristic. This talk is intended to be (mostly) comprehensible to a broad audience.

Algebraic Geometry Seminar (Lectures in Algebraic Geometry, Talk II)
Wednesday, March 5, 4:10-6:00pm
3088 EH
Ravi Vakil (Stanford)
Reimagining universal covers and fundamental groups in algebraic and arithmetic geometry

In topology, the notions of the fundamental group and the universal cover are inextricably intertwined. In algebraic geometry, the traditional development of the etale fundamental group is somewhat different, reflecting the perceived lack of a good universal cover.
However, I will describe how the usual notions from topology carry over directly to the algebraic and arithmetic setting without change, rectifying imperfections in the etale fundamental group.

One key example is the absolute Galois group scheme, which contains more information than the traditional absolute Galois group, in a choice-free manner, and has a rich arithmetic structure. Its geometric fiber is the classical absolute Galois group as a topological group (the profinite topology is the Zariski topology, and comes from geometry). I will also discuss the example of abelian varieties and the Tate module. This is joint work with Kirsten Wickelgren.

Commutative Algebra Seminar
Thursday, March 6, 3:10-4:00pm
3096 EH
Mel Hochster (UM)
Phantom homology (cont.)

This is the second of several lectures that will deal with phantom homology. The idea is that one may have a complex such that the cycles are in the tight closure of boundaries. The homology at that spot is said to be "phantom." If one makes a base change to a ring, such as a regular ring, in which submodules are always tightly closed, the image of the homology of the complex vanishes. This technique leads to deep theorems that are difficult or, so far as we know, impossible to prove by other methods.
Familiarity with the basic notions of tight closure theory will be assumed

Financial/Actuarial Mathematics Seminar
Thursday, March 6, 3:10-4:00pm
3088 EH
Semih Sezer (UM)
Finite Horizon Decision Timing with Partially Observable Poisson Processes

We study decision timing problems on finite horizon with Poissonian information arrivals. In our model, a decision maker wishes to optimally time her action in order to maximize her expected reward. The reward depends on an unobservable Markovian environment, and information about the environment is collected through a (compound) Poisson observation process. Examples of such systems arise in investment timing, reliability theory, Bayesian regime detection and technology adoption models. We solve the problem by studying an optimal stopping problem for a piecewise-deterministic process, which gives the posterior likelihoods of the unobservable environment. Our method lends itself to simple numerical implementation and we present several illustrative numerical examples.
This is joint work with Michael Ludkovski (U of M).

Differential Equations
Thursday, March 6, 4:10-5:00pm
4088 EH
Charlie Doering (UM)
Statistically Stationary Stirring with Steady Sources and Sink

We discuss applications, models, analysis and simulation of mixing of a passive scalar field sustained by temporally steady but spatially inhomogeneous sources. We consider a broad class of statistically stationary incompressible flows and measure the mixing in terms of scalar field variance supression in the presence of the stirring relative to that in the presence of molecular diffusion alone. Notions of "eddy diffusion" or "effective diffusion" of flows are discussed.

Math Club (Note: Unusual Location)
Thursday, March 6, 4:10-5:00pm
1360 EH
Jeff Lagarias (UM)
Apollonian circle packings **(Undergraduate Colloquium)**

Apollonian circle packings are infinite packings of cicles, constructed recursively from an initial configuration of four mutually touching circles by adding circles externally tangent to triples of such circles. Configurations of four mutually touching circles were studied by Descartes in 1643. If the initial four circles have integer curvatures, so do all the circles in the packing. If, in addition, the circles have rational centers, then so do all of the circles in the packing. Why?
This talk describes results in geometry, group theory, and number theory arising from such packings. (This is joint work with Ron Graham, Colin Mallows, Allan Wilks, and Catherian Yan.)

Algebraic Geometry Seminar (Lectures in Algebraic Geometry, Talk IV)
Friday, March 7, 3:10-4:00pm
4088 EH
Ravi Vakil (Stanford)
A natural smooth compactification of the space of smooth genus one curves in a projective space

The space of smooth genus 0 curves in projective space has a natural smooth compactification: the moduli space of stable maps, which may be seen as the generalization of the classical space of complete conics.
It has a beautiful combinatorial structure. In arbitrary genus, no such natural smooth model is expected, as the space satisfies ``Murphy's Law''. In genus 1, however, the situation remains beautiful and combinatorial. I will describe a natural smooth compactification of the space of elliptic curves in projective space.
This space is a blow up of the space of stable maps. It can be interpreted as blowing up the most singular locus first, then the next most singular, and so on, but with a twist --- these loci are often entire components of the moduli space. I will give a number of applications in enumerative geometry and Gromov-Witten theory. For example, it has been used by Aleksey Zinger to prove physicists' famous mirror symmetry prediction for genus 1 Gromov-Witten invariants of a quintic threefold. This is joint work with Zinger.

Applied and Interdisciplinary Mathematics Seminar
Friday, March 7, 3:10-4:00pm
1084 EH
Jing Shi (Wayne State)
Numerical Methods for Multidimensional Tunneling Transitions: A Quantum Transition State Theory

Quantum tunneling plays crucial roles in some physical and chemical processes, ranging from quantum cosmology to enzymatic reactions. The quantum nature of the motion often comes along with multidimensionality, namely the coupled motion of many degrees of freedom. The high dimensionality of the potential energy surface poses a great challenge in both theoretical and numerical descriptions of tunneling. Numerical simulation based on the Schrodinger equation is often prohibitively expensive. We develop an efficient and accurate numerical method to calculate the tunneling transition, based on the path integral formulation ('instanton') of quantum transition state theory. It is free from any further ad hoc assumptions ('adiabatic' or 'sudden') and does not require pre-defined reaction coordinates. The application to hydrogen tunneling transfer in polyatomic molecules will also be demonstrated.