Winter 2008
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
January 14th – January 20th

Monday, January 14

3:10-4:00pm **Student Analysis Seminar** --- TBA --- 3866 EH
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Radu Laza (UM) *Introduction to Log Geometry* --- 2866 EH
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Samit Dasgupta (Harvard) *A p-adic approach to Hilbert's 12th Problem* --- 4096 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Erlend Wold (U of Oslo) *A counterexample to uniform approximation on totally real manifolds in $\mathbb{C}^3$* --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- TBA --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

Tuesday, January 15

2:10-3:00pm "**What is … " Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Ben Schmidt (Chicago) *Generalizing the three gap theorem to isometries and certain geodesic flows* --- 4088 EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH
4:10-5:00pm **Colloquium (Rainich Lectures-1st talk)** --- Gang Tian (Princeton) *Geometric analysis of low dimensional manifolds* --- 1360 EH

Wednesday, January 16

4:10-5:00pm **Rainich Lectures-2nd talk** --- Gang Tian (Princeton) *Geometric analysis of low dimensional manifolds* --- 3096 EH
3:10-4:00pm **Geometric Function Theory Seminar** --- Not meeting this week --- 4096 EH
3:10-4:00pm **Student Representation Theory/Lie Theory Seminar** --- TBA --- 4096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- TBA --- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- TBA --- Room TBA
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Erlend Wold (U of Oslo) *Carlemann approximation on totally real manifolds* --- 4088 EH
4:10-5:00pm **Algebraic Geometry Seminar (Part 1)** --- Gueorgui Todorov (Utah) *Pluricanonical maps on threefolds* --- 3088 EH
5:10-6:00pm **Algebraic Geometry Seminar (Part 2)** --- Dawei Chen (Harvard) *Mori's program for the Kontsevich moduli space* --- 3088 EH

Thursday, January 17

3:10-4:00pm **Rainich Lectures-3rd talk** --- Gang Tian (Princeton) *Geometric analysis of low dimensional manifolds* --- 1360 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Not meeting this week --- 3088 EH
3:10-4:00pm **Commutative Algebra Seminar** --- Wenliang Zhang (Minnesota) *On Lyubeznik numbers of projective schemes* --- 3096 EH
3:10-4:00pm **Topology Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Differential Equations** --- Ovidiu Calin (EMU) *Finding Heat Kernels using Geometric Mechanics* --- 4088 EH
4:10-5:00pm **Math Club** --- Juan Souto (UM) *The Poincare conjecture and the classification of manifolds* --- 2nd floor Nesbitt Common Room
4:10-5:00pm **Student Combinatorics** --- Luis Serrano (UM) *Hyperplane Arrangements I* --- 3866 EH
5:00-6:00pm **Study Seminar (Note the exceptional time)** --- Pekka Pankka (UM) *Harmonic functions on polynomially growing groups (after Kleiner)* --- 3088 EH

Friday, January 18

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

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Juan Meza (LBNL) *A Direct Constrained Optimization Method for Solving the Kohn-Sham Equations* --- 1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Diane Vavrichek (UM) *Algebraic Geometry over Groups* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Federico Ardila (SFSU) *Tropical hyperplane arrangements and oriented matroids* --- 3866 EH

4:10-5:00pm **Complex Analysis Seminar** --- Peter Duren (UM) *Schwarzian derivatives of analytic and harmonic functions* --- 4088 EH

EVENTS THIS WEEK

Rainich Lectures
Tian Gang (Princeton)
Series Title: Geometric Analysis of Low Dimensional Manifolds

Schedule of Talks:
Tuesday, January 15, 4:00-5:00 --- 1360 EH
Wednesday, January 16, 3:00-4:00 --- 3096 EH
Thursday, January 17, 3:00-4:00 --- 4088 EH

In these lectures, I will discuss how to study geometry and topology of low dimensional manifolds by analytic methods. I will start with classical uniformization theorem in differential geometry and explain how it can be used to studying surfaces and 3-manifolds. Then I will discuss briefly the Ricci flow and geometrization of 3-manifolds. Finally, I will discuss recent progress on metric geometry of 4-manifolds and its relation to topology of 4-manifolds. Some open problems will also be presented.

UPCOMING EVENTS

Dr. Marjorie Lee Browne Colloquium
(as part of the University of Michigan's Rev. Dr. Martin Luther King, Jr. Symposium)
Monday, January 21, 4:00-5:00pm
1360 EH
Juan Meza (Lawrence Berkeley National Laboratory)
I Want to Be a (Computational) Mathematician

Twenty years ago Halmos wrote a wonderful book entitled I Want to Be a Mathematician, describing his life as a mathematician, while also giving us a history of mathematics from the 1930s to the 1980s. I read his book while in graduate school and delighted in the stories and his perspectives on life as a mathematician. In this talk, I'd like to give my own perspective, beginning when I became interested in mathematics as an undergraduate to today, focusing on some recent work on new algorithms, massively parallel computers, and the application of both to some of today's most challenging problems. This combination of mathematics with computers has given rise to the field of computational mathematics, which has helped to advance computational science to the point that many people today now view it as the third pillar of science alongside experiments and theory. I will give examples of the power of computational mathematics drawn from my personal experiences and explain how mathematics amplifies scientific research. I will conclude with some thoughts on the future of computational and applied mathematics and what I see as the challenging new opportunities for helping science and society as a whole.

Ziwet Lectures
Feb. 5-7, 2008
Speaker: Curtis McMullen
Series Title: Dynamics and moduli spaces

Schedule:
Tuesday, February 5, 4:00-5:00pm --- Room TBA
Billiards and Teichmueller Theory

Wednesday, February 6, 4:00-5:00pm --- 1360 EH
Islands on algebraic surfaces

Thursday, February 7, 3:00-4:00pm --- Room 1360 EH
Topology of numbers

These talks will present progress and open problems at the interface between dynamical systems and moduli spaces of complex manifolds and Euclidean lattices.

Note: all talks will be accessible to a general audience, and none is a prerequisite for any other.

ABSTRACTS FOR THE WEEK OF JAN. 14– JAN. 20, 2008

Number Theory and Representation Theory Seminar
Monday, January 14, 3:10-5:00pm
4096 EH
Samit Dasgupta (Harvard)
A p-adic approach to Hilbert's 12th Problem

It is well-known that the square root of any integer can be written as a linear combination (with rational coefficients) of roots of unity. A generalization of this fact is the "Kronecker-Weber Theorem" which states that any algebraic number which generates an abelian Galois extension of the field Q of rational numbers can also be written as such a linear combination. The roots of unity may be viewed as special values of the analytic function e(x) = exp(2pi i x), Where x is taken to be a rational number. Broadly speaking, Hilbert's 12th Problem is to find an analogous result when Q is replaced with a general algebraic number field F, and in particular to find the analytic functions that play the role of e(x) in this general setting.

Hilbert's 12th problem has been solved when F is an imaginary quadratic field, with the role of e(x) played by certain modular functions. All others cases are, generally speaking, unresolved.
In this talk I will discuss the case when F is a real quadratic field, and more generally a totally real field. I will describe relevant conjectures of Stark and Gross, as well as current work using a p-adic approach and methods of Shintani. A proof of these conjectures would arguably provide a positive resolution of Hilbert's 12th problem in these cases.

Several Complex Variables Seminar
Monday, January 14, 4:10-5:00pm
3096 EH
Erlend Wold (U of Oslo)

A counterexample to uniform approximation on totally real manifolds in $\mathbb{C}^3$

We will construct a closed submanifold M of $\mathbb{C}3$ such that M is diffeomorphic to $\mathbb{R}2$ and has the following properties: 1) M is totally real, 2) M is polynomially convex, but 3) Continuous functions on M cannot be approximated uniformly by entire functions. Note that by 1) and 2) uniform approximation is possible on compact pieces of M.

Geometry Seminar
Tuesday, January 15, 3:10-4:00pm
4088 EH
Ben Schmidt (Chicago)
Generalizing the three gap theorem to isometries and certain geodesic flows

Let *n* be a natural number and *p* a real number. The three gap theorem asserts that there are at most *three* distinct gaps between consecutive elements in the set of fractional parts of the first *n* multiples of the number *p*. I'll discuss generalizations that pertain to isometries of closed Riemannian manifolds and certain geodesic flows. This is joint work with Ian Biringer (Chicago).

Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, January 16, 4:10-5:30pm
4088 EH
Erlend Wold (U of Oslo)
Carlemann approximation of totally real manifolds

We will discuss work in progress concerning necessary and sufficient conditions for Carlemann approximation (better and better approximation as you approach infinity) by entire functions on totally real polynomially convex manifolds.

Commutative Algebra Seminar
Thursday, January 17, 3:10-4:00pm
3096 EH
Wenliang Zhang (Minnesota)
On Lyubeznik numbers of projective schemes

In this talk I will give a complete characterization of the highest Lyubeznik number of a local ring and discuss some recent progress concering these numbers for a projective scheme over a field.

Differential Equations
Thursday, January 17, 4:10-5:00pm
4088 EH
Ovidiu Calin (EMU)
Finding Heat Kernels using Geometric Mechanics

Geometric Mechanics has useful and important applications to PDEs and quantum mechanics. We shall present a geometric method which deals with the construction of heat kernels for Hermite-type operators, Kolmogorov operators as well as operators with linear, quadratic and inverse square potential in one and several dimensions.

Math Club
Thursday, January 17, 4:10-5:00pm
2nd floor Nesbitt Common Room
Juan Souto (UM)
The Poincare conjecture and the classification of manifolds

In 1904, Poincare asked if among all (compact and connected) 3-dimensional ``spaces'', the 3-dimensional sphere is characterized by the property that every loop in it can be shrunk to a point. Over time, his question because known as the Poincare conjecture. After many attempts to solve it and many spectacular results in other dimensions, the Poincare conjecture was still unsolved in 2000 when it was considered by the Clay Mathematics Institute to be one of the 7 Millenium Problems. Shortly afterwards, Perelman solved it and his achievement was rewarded with the Fields Medal. In this talk, I will discuss the Poincare conjecture and some of its cousins.

Study Seminar (Note the exceptional time)
Thursday, January 17, 5:00-6:00pm
3088 EH
Pekka Pankka (UM)
Harmonic functions on polynomially growing groups (after Kleiner)

A recent paper of Bruce Kleiner gives a new proof of Gromov's theorem on virtual nipotency of finitely generated groups of polynomial growth. The proof is based on finite dimensionality of the space of harmonic functions on a Cayley graph of the group. I will focus on this part of the paper.

Applied and Interdisciplinary Mathematics Seminar
Friday, January 18, 3:10-4:00pm
1084 EH
Juan Meza (LBNL)
A Direct Constrained Optimization Method for Solving the Kohn-Sham Equations

Density functional theory (DFT) is the most widely used ab initio method in computational chemistry and material simulations. Using DFT codes, one can calculate the electronic structure, the charge density, and the total energy of an electronic system. And with the advance of new algorithms and supercomputers, we can now study many thousand-atom systems, with applications including the study of solar cells for renewable energy, biomedical imaging, and the design of novel materials. At the heart of many of these codes, one typically finds a Self Consistent Field (SCF) iteration for solving the Kohn-Sham equations. In this talk, I will discuss an alternative approach based on an optimization method that minimizes the Kohn-Sham total energy directly. I will also discuss a trust region technique as a way to improve convergence of the overall method. Numerical experiments demonstrate that the combination of these approaches is more efficient and robust than SCF alone, which can be shown to fail in certain cases.

Student Geometry/Topology
Friday, January 18, 3:10-4:00pm
3096 EH
Diane Vavrichek (UM)
Algebraic Geometry over Groups

We will introduce some of the basic objects and results in this new area of geometric group theory.

Combinatorics
Friday, January 18, 4:10-5:00pm
3866 EH
Federico Ardila (SFSU)
Tropical hyperplane arrangements and oriented matroids

I will define the notion of a tropical oriented matroid (TOM), an object which captures the combinatorial structure of a tropical hyperplane arrangement, and shares several of the properties of ordinary oriented matroids. I will show how a TOM determines a subdivision of a product of two simplices, and provide strong evidence that this correspondence is a bijection. I will conclude with several open problems.
The talk will assume no previous knowledge of tropical geometry or matroid theory. This is joint work with Anna Brown and Mike Develin.

Complex Analysis Seminar
Friday, January 18, 4:10-5:00pm
4088 EH
Peter Duren (UM)
Schwarzian derivatives of analytic and harmonic functions

This talk will begin with a brief historical review of Schwarzian derivatives of analytic functions and their applications, including Nehari's criteria for univalence. Then I propose to discuss Schwarzians of complex-valued harmonic functions, as defined recently by Martin Chuaqui, Brad Osgood, and myself. Criteria for univalence and estimates of valence will be given, some of which appear to be new even for analytic functions.
In this regard it is natural to identify a harmonic mapping with its canonical lift to a minimal surface.