

Fall 2006  
University of Michigan-Department of Mathematics  
<http://www.math.lsa.umich.edu/seminars/index.shtml>  
Ann Arbor, MI 48109-1043  
**October 9th – October 15th**

**Monday, October 9**

- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- David Speyer (UM) *Writing down Solutions to Hypergeometric Differential Equations* --- 3866 EH  
3:10-4:30pm **Arithmetic/Number Theory Seminar** --- Not meeting this week --- 4096 EH  
4:10-5:00pm **Several Complex Variables Seminar** --- Tatyana Foth (U of Western Ontario) *Holomorphic line bundles and automorphic forms* --- 3096 EH  
4:10-6:00pm **Group Theory/Lie Theory Seminar** --- Not meeting this week --- 4088 EH  
4:10-6:00pm **Geometry & Physics** --- Yongbin Ruan (UM) *Witten equation and the singularities theory (continued)* --- 3088 EH

**Tuesday, October 10**

- 12:10-1:00pm **Student Algebraic Geometry Seminar** --- Fidel Jimenez (UM) *Singularities of maps to projective space* --- 1068 EH  
2:10-3:00pm **Geometry Seminar** --- Juha Heinonen (UM) *An analytic condition for smoothability of Lipschitz manifolds* --- 4088 EH  
3:10-4:00pm **Algebra Seminar** --- Not meeting this week --- 3096 EH  
4:10-5:00pm **Colloquium** --- Stephen Smale (Toyota Technological Inst.) *Reconstruction of submanifolds of euclidean space from random data* --- 1360 EH

**Wednesday, October 11**

- 3:10-4:00pm **Student Arithmetic Seminar** --- Johnson Jia (UM) *Converse to Herbrand's Theorem* --- 3866 EH  
3:10-4:00pm **Student AIM Seminar** --- Ajinkya More (UM) *Graph Theory and its Applications to Computational Biology* --- 3096 EH  
3:10-5:00pm **Geometric Function Theory Seminar** --- Kevin Wildrick (UM) *Sharpness of absolute continuity results for quasiconformal mappings in metric spaces* --- 4096 EH  
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Michal Jasiczak (UM) *The dbar equation on currents* --- 4088 EH  
4:10-5:00pm **Student Analysis Seminar** --- Marie Snipes (UM) *Hausdorff Measure of Unit Balls in Finite Dimension* --- 3866 EH  
4:10-6:00pm **Algebraic Geometry Seminar** --- Dauvish Maulik (Princeton) *GW/DT correspondence for toric threefolds* --- 3088 EH

**Thursday, October 12**

- 3:10-4:00pm **Commutative Algebra Seminar** --- Not meeting this week --- 3096 EH  
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Not meeting this week --- 3088 EH  
3:10-4:00pm **Topology Seminar** --- Not meeting this week --- 4096 EH  
3:10-5:00pm **Analysis Study Seminar** --- Pekka Pankka (UM) *Volume growth and hyperbolicity (continued)* --- 2866 EH  
4:10-5:00pm **Math Club** --- *Graduate School Discussion Panel* --- 1324 EH  
4:10-5:00pm **Student Combinatorics** --- Aubrey da Cunha (UM) *A Crash Course in Root Systems and Coxeter Groups, Part II* --- 3866 EH  
4:10-5:00pm **Differential Equations** --- Joel Smoller (UM) *Stability of Black Holes* --- 4096 EH  
4:10-5:30pm **Logic Seminar** --- Carl Mummert --- *Computability, Reverse Mathematics, and Ramsey's Theorem (II)* --- 3096 EH

**Thursday, October 12 (continued)**

- 4:30-5:30pm **Theoretical Computer Science Seminar** --- Ye Du (UM) *A Global Geometric Framework for Nonlinear Dimensionality Reduction and Nonlinear Dimensionality Reduction by Locally Linear Embedding (Tenenbaum, de Silva, Langford and Roweis, Saul)* --- CSE 3941
- 5:15-6:30pm **Teaching Mathematics** --- Natasha Speer (MSU) *On the road to being a teacher of college mathematics: Graduate students' knowledge and beliefs about student thinking in calculus* --- 3088 EH

**Friday, October 13**

- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** ---Selim Esedoglu (UM) *An algorithm for image segmentation based on convex duality*---1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- Cagatay Kutluhan (UM) *Lefschetz Fibrations* --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Not meeting this week --- 3866 EH

**UPCOMING EVENTS:**

**2006-07 Rainich Lectures  
October 30-November 3, 2006  
Phil Holmes (Princeton University)  
Schedule and talks TBA**

**ABSTRACTS FOR THE WEEK OF OCT. 9 – OCT. 15, 2006**

**Topics in Algebraic Geometry Seminar  
Monday, October 9, 3:10-4:00pm  
3866 EH  
David Speyer (UM)**

***Writing down Solutions to Hypergeometric Differential Equations***

I will explain how to write down explicit power series solutions to any GKZ-hypergeometric equation for generic values of beta. This talk should have lots of pretty polyhedral combinatorics.

**Several Complex Variables Seminar  
Monday, October 9, 4:10-5:00pm  
3096 EH  
Tatyana Foth (U of Western Ontario)  
*Holomorphic line bundles and automorphic forms***

Let  $D$  be an irreducible bounded symmetric domain in  $\mathbb{C}^n$ . Automorphic forms on  $D$  are holomorphic functions on  $D$  with special properties. I will explain a way to construct them explicitly in the case  $n > 1$ . This generalizes a well-known Petersson's result for automorphic forms on the upper-half plane  $SL(2, \mathbb{R})/SO(2)$  (or, equivalently, the unit disc  $SU(1, 1)/U(1)$ ), which is the case  $n = 1$ .

**Geometry Seminar**  
**Tuesday, October 10, 2:10-3:00pm**  
**4088 EH**

**Juha Heinonen (UM)**  
***An analytic condition for smoothability of Lipschitz manifolds***

Traditionally, smoothability criteria for topological or PL manifolds are expressed in terms of algebraic topological obstructions (with one geometric exception to be mentioned). I will present an analytic criterion for the smoothability of a Lipschitz manifold, based on the idea of a cotangent structure over such manifold proposed by D. Sullivan. This is joint work with Stephen Keith.

**Colloquium**  
**Tuesday, October 10, 4:10-5:00pm**  
**1360 EH**

**Stephen Smale (Toyota Technological Inst.)**  
***Reconstruction of submanifolds of euclidean space from random data***

Both the homology groups and the geometry of a submanifold, represented by points drawn at random, will be analyzed. Relations to the medial axis, and to the visual cortex will be discussed.

**Student AIM Seminar**  
**Wednesday, October 11, 3:10-4:00pm**  
**3096 EH**

**Ajinkya More (UM)**  
***Graph Theory and its Applications to Computational Biology***

Algorithms based on graph theory have simplified the solution of numerous problems in Computational Biology. Some examples include protein clustering, RNA sequencing, isothermic DNA sequencing, evolutionary tree construction. I shall be discussing some of these problems and relevant graph theoretic algorithms that are usually employed in solving these.

**Geometric Function Theory Seminar**  
**Wednesday, October 11, 3:10-5:00pm**  
**4096 EH**

**Kevin Wildrick (UM)**  
***Sharpness of absolute continuity results for quasiconformal mappings in metric spaces***

A recent theorem of Balogh, Koskela, and Rogovin generalized classic absolute continuity results for quasiconformal mappings to a metric setting in which no Poincaré inequality is assumed. We show that these results are in some sense sharp by constructing an example based on the Cantor function. This is joint work with Pekka Koskela.

**Student Analysis Seminar**  
**Wednesday, October 11, 4:10-5:00pm**  
**3866 EH**  
**Marie Snipes (UM)**  
***Hausdorff Measure of Unit Balls in Finite Dimension***

We will give an introduction to Hausdorff measure, and then prove the following interesting result due to Kirchheim: In any  $n$ -dimensional normed metric space, the Hausdorff measure of the unit ball is the same as in the  $n$ -dimensional Euclidean space.

**Analysis Study Seminar**  
**Thursday, October 12, 3:10-5:00pm**  
**2866 EH**  
**Pekka Pankka (UM)**  
***Volume growth and hyperbolicity (continued)***

I will discuss a theorem of Varopoulos on the growth bounds for fundamental groups of closed quasiregularly elliptic manifolds [Varopoulos - Saloff-Coste - Coulhon, Analysis and geometry on groups, Theorem X.5.1].

**Math Club**  
**Thursday, October 12, 4:10-5:00pm**  
**1324 EH**  
***Graduate School Discussion Panel***

Panel: Victoria Booth, Djordje Milicevic, Lan Nguyen, Sonmez Sahutoglu, Karl Schwede, Joel Tropp, Kyle Petersen, Tamar Ziegler

Come and have your questions about graduate school answered. Panel members will dispense helpful advice on many topics. For example, freshman and sophomores might be interested to learn what they should be doing now to help them get in to graduate school. Meanwhile, juniors and seniors might like to find out how to choose a graduate advisor so that they can eventually get out of graduate school.

**Differential Equations**  
**Thursday, October 12, 4:10-5:00pm**  
**4096 EH**  
**Joel Smoller (UM)**  
***Stability of Black Holes***

We consider decay of solutions of the Cauchy Problem for various fields in the Kerr (rotating Black Hole) geometry. We discuss the formulation of the problem in terms of the Teukolsky equation, a single second-order PDE depending on a real parameter  $s$ , the "spin". For various values of  $s$ , the Teukolsky equation describes different fields in the Kerr geometry:  $s=0, 1/2, 1, 2$ , correspond, respectively, to scalar waves, Dirac's equation, Maxwell's equations, and gravitational waves. We discuss our results for  $s=0, 1/2$ , as well as our rigorous proof of Penrose's proposal (1969) for energy extraction from a Kerr BH. In the case of a Schwarzschild (non-rotating) BH, we discuss our decay results, and hence stability of this BH, for all spin.

**Logic Seminar**  
**Thursday, October 12, 4:10 – 5:30 pm**  
**3096 EH**

**Carl Mummert**  
***Computability, Reverse Mathematics, and Ramsey's Theorem (II)***

This is the second talk in a series. I will discuss the proof of Seetapun's result that every computable instance of Ramsey's theorem for pairs has a homogeneous set that does not compute  $0'$ . Then I will discuss results of Cholak, Jockusch, and Slaman on the proof-theoretic strength of Ramsey's theorem for pairs. If time permits, I will also discuss more recent results involving combinatorial theorems weaker than Ramsey's theorem for pairs.

**Teaching Mathematics**  
**Thursday, October 12, 5:15-6:30pm**  
**3088 EH**

**Natasha Speer (MSU)**  
***On the road to being a teacher of college mathematics: Graduate students' knowledge and beliefs about student thinking in calculus***

The past several decades have brought advances in what the mathematics education community knows about how undergraduate students think about and learn foundational concepts in calculus such as limit and derivative. In addition, researchers have examined the ways that students' understanding of more elementary concepts (such as function) interacts with the learning of calculus. Experienced teachers of college mathematics have knowledge of these ways that students think and make use of it as they plan and carry out instruction. What is unknown, however, is when and how this knowledge develops. This presentation reports on research done to investigate the nature of the knowledge of student thinking possessed by beginning college teachers as well as beliefs that influence their use of that knowledge. Using problems from (and modeled after) the problems used in research on students' thinking, mathematics graduate students were interviewed about typical strategies and difficulties students might exhibit while working on the problems. Implications for professional development and further research will also be discussed.

**Applied and Interdisciplinary Mathematics Seminar**  
**Friday, October 13, 3:10-4:00pm**  
**1084 EH**

**Selim Esedoglu (UM)**  
***An algorithm for image segmentation based on convex duality***

Given an image depicting a scene with several objects in it, the goal of image segmentation is to partition the image into regions that contain distinct objects. Variational models for segmentation pose the problem as finding the minimizer of a suitably chosen energy. One of the most popular among them is the model of Mumford and Shah. After reviewing how a simplified version of the Mumford-Shah model can be formulated as a convex but non-smooth optimization problem, we will describe a dual formulation that turns it into a smooth optimization problem and allows more efficient numerical solution.