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

Monday, February 2

3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Matthew Simpson (UM) *Introduction to GIT* --- 2866 EH
3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- Berit Stensones (UM) *Finite D'Angelo type in C^3* --- 3096 EH
4:10-5:00pm **Student Combinatorics** --- Austin Shapiro (UM) *Families of subsets of a finite set* --- 3866 EH
4:10-6:00pm **Geometry and Physics Seminar** --- TBA --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3096 EH

Tuesday, February 3

2:10-3:00pm "**What is … " Seminar** --- Jim Milne (UM) *What is … a motive?* --- 3096 EH
3:10-4:00pm **Algebra Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Zhou Zhang (UM) *Scalar curvature behavior of K\"ahler-Ricci flow* --- 3866 EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- Eugene Eisenstein (UM) *Singularity classes in the MMP: terminal, canonical, and all that jazz* --- 3088 EH
3:10-4:00pm **Student Seminar in Complex Dynamical Systems** --- TBA --- 4088 EH
4:10-5:00pm **Colloquium** --- Joel Smoller (UM) *A One Parameter Family of Expanding Wave Solutions of the Einstein Equations That Induces an Anomalous Acceleration Into the Standard Model of Cosmology* --- 1360 EH
4:10-5:00pm **Student AIM Seminar** --- TBA --- 3088 EH

Wednesday, February 4

11:10-12:00pm **Financial/Actuarial Mathematics Seminar (Non-standard day/time)** --- Guoliang Wu (U of California, Berkeley) *Smooth Fit Principle for Multidimensional Impulse Control Problems* --- 3088 EH
3:10-4:00pm **Geometric Function Theory Seminar** --- TBA --- 4096 EH
3:10-4:00pm **Student Representation Theory Seminar** --- Farkhod Eshmatov (UM) TBA --- 3096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- Leo Goldmakher (UM) TBA --- 3088 EH
4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Rodrigo Parra (UM) *Laminar currents in P^2* --- 3096 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Yusuf Mustopa (Stony Brook) *Cones of Divisor Classes on Symmetric Powers of Curves* **---** 3088 EH

Thursday, February 5

3:10-4:00pm **Commutative Algebra Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Topology Seminar** --- Johanna Mangahas (UM) *Uniform uniform exponential growth of subgroups of the mapping class group* --- 4088 EH
4:10-5:00pm **Differential Equations** --- Marshall Slemrod (Wisconsin) *Isometric embedding, gas dynamics, and compensated compactness* --- 4088 EH
4:10-5:00pm **Math Club** --- Kyle Ormsby (UM) *The Geometry of the Hopf Fibration* --- 2nd floor Nesbitt Common Room
4:10-6:00pm **RTG Study Seminar** --- TBA --- 3866 EH

Friday, February 6

11:10-12:00pm **Theoretical Computer Science Seminar** --- Andrey Goder (UM) *Incremental Cycle Detection, Topological Ordering, and Strong Component Maintenance* --- CSE 3941

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Richard Kollar (UM) *A Mathematical Model for Heat Damage of Cells* --- 1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Johanna Mangahas (UM) *Growth of groups: a short survey with examples* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Not meeting this week --- 3866 EH

ABSTRACTS FOR THE WEEK OF FEB. 2 – FEB. 8, 2009

Several Complex Variables and Complex Dynamics Seminar
Monday, February 2, 4:10-5:00pm
3096 EH
Berit Stensones (UM)
Finite D'Angelo type in C^3

We shall study bounded pseodoconvex domains of finite type in C^3. The goal of the talk is to describe an algorithm that identifies the complex curves that has an exceptional high order of contact with the boundary of such a domain. This enables us to show that there is only "finitely" many such domains.

Student Combinatorics
Monday, February 2, 4:10-5:00pm
3866 EH
Austin Shapiro (UM)
Families of subsets of a finite set

Given a finite set X, how many subsets can we choose so that any two intersect? Or so that no chosen subset is contained in another?
I will demonstrate the use of Erdős's "probabilistic method" as a tool for answering these types of questions. I'll also talk a bit about the state of knowledge in finite poset combinatorics.

"What is … " Seminar
Tuesday, February 3, 2:10-3:00pm
3096 EH
Jim Milne (UM)
What is … a motive?

Grothendieck introduced the notion of a "motif" in a letter to Serre in 1964. Later he wrote that, among the objects he had been privileged to discover, they were the most charged with mystery and formed perhaps the most powerful instrument of discovery. In this talk, I shall explain what motives are, and why Grothendieck valued them so highly.

Geometry Seminar
Tuesday, February 3, 3:10-4:00pm
3866 EH
Zhou Zhang (UM)
Scalar curvature behavior of K\"ahler-Ricci flow

In this talk, we discuss general behavior of scalar curvature along Kähler-Ricci flow over a closed manifold. This can be considered as a test for the more geometric picture of the flow metric.

Colloquium
Tuesday, February 3, 4:10-5:00pm
1360 EH
Joel Smoller (UM)
A One Parameter Family of Expanding Wave Solutions of the Einstein Equations That Induces an Anomalous Acceleration Into the Standard Model of Cosmology

In the early 1920's theoretical astronomers came up with the so-called Standard Model of Cosmology, also called the FRW (Friedman-Robertson-Walker) spacetime. It was based on the so-called Cosmological, or Copernican, principle: the universe is homogenious (no preffered point), and isotropic (no preferred direction). In 1927, the American astronomer Edwin Hubble showed that the Universe is expanding: distant galaxies were receding from each other, and thus confirmed the standard model. In 1998, astronomers made the astounding discovery that the Universe was actually accelerating. This discovery implied that the Standard Model was incorrect, and had to be abandoned. This in turn, led to a flurry of research and theoreticians came up with a model that modified the Einstein equations by adding on a term, the so-called "cosmological constant". This was very ad-hoc (no theory behind it) and amounted to nothing more than a "fudge factor". This extra term then led to the concept of "dark energy" an un-observed, unphysical (negative pressure) notion, which was (amazingly!) generally accepted by the physics community. My talk will be concerned with the recent work of Blake Temple and myself stemming from an idea of Temple, that the anomalous acceleration of the galaxies might be due to a secondary expansion wave reflected back from the shock wave in our shock wave cosmology model. He set out with a student Zeke Vogler to numerically simulate the shock wave by a locally inertial numerical method that he and Groah derived. When Temple held The Gehring Chair at Michigan in the Fall of 2007, he invited me to join him on this project, and together we discovered a surprising new family of expansion waves that perturb the standard model, independent of the shock wave. This result led to a mathematically rigorous, non- ad-hoc, possible explanation of the accelerating Universe, based only upon The Einstein Equations of General Relativity.

Financial/Actuarial Mathematics Seminar (Non-standard day/time)
Wednesday, February 11:10-12:00pm
3088 EH
Guoliang Wu (U of California, Berkeley)
Smooth Fit Principle for Multidimensional Impulse Control Problems

Impulse control problems have wide applications in economics and engineering. To obtain closed-form solutions, "smooth fit principle" is essential. I will talk about the smooth-fit C1 property of the value functions for impulse controls of multidimensional diffusions and jump diffusions, using a viscosity solution approach and PDE tools.

RTG Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, February 4, 4:10-5:00pm
3096 EH
Rodrigo Parra (UM)
Laminar currents in P^2

Given a sequence of irreducible curves (C_n) in P^2 converging to T in the sense of currents, there is a geometric condition on the curves ensuring that the limit current T is laminar. We explore this condition and then applied this to meromorphic dynamical systems in P^2, and laminarity of the dynamical Green current T.

Algebraic Geometry Seminar
Wednesday, February 4, 4:10-6:00pm
3088 EH
Yusuf Mustopa (Stony Brook)
Cones of Divisor Classes on Symmetric Powers of Curves

The d-th symmetric power C_{d} of a smooth projective curve C is the parameter space for effective divisors of degree d on $C.$ As such, the degree-d aspect of the geometry of C is encoded in the subvarieties of $C_{d}.$ We discuss new bounds for the effective and movable cones of C_{d} when C is a curve of genus $g \geq 4$ and work in progress regarding the nef cone of C_3 when C is a general curve of genus 5.

Topology Seminar
Thursday, February 5, 3:10-4:00pm
4088 EH
Johanna Mangahas (UM)
Uniform uniform exponential growth of subgroups of the mapping class group

Let Mod(S) denote the mapping class group of a compact, orientable surface S. Finitely generated subgroups of Mod(S) which are not virtually abelian have uniform exponential growth with minimal growth rate bounded below by a constant depending only on S. We describe the proof of this and related results.

Differential Equations
Thursday, February 5, 4:10-5:00pm
4088 EH
Marshall Slemrod (Wisconsin)
Isometric embedding, gas dynamics, and compensated compactness

In this talk I will outline recent work of G-Q Chen, Dehua Wang, and M. Slemrod on the almost dual nature between the classical problems of 1/isometric embedding of a three dimensional Riemannian manifold into three dimensional Euclidean space, and 2/ steady irrotational isentropic inviscid 2D compressible gas dynamics.

Math Club
Thursday, February 5, 4:10-5:00pm
2nd floor Nesbitt Common Room
Kyle Ormsby (UM)
The Geometry of the Hopf Fibration

Heinz Hopf introduced his eponymous fibration in 1931 in a successful attempt to weird out the mathematical community. Seen one way, the Hopf fibration tells you how the 3-sphere can be wrapped around the 2-sphere. Seen another way, it provides instructions for how to glue 2-spheres and circles together in order to reproduce the 3-sphere.

In this talk, I will use hand gestures, chalk, an inner-tube, and hula-hoops to:

- define the 3-sphere,
- visualize the Hopf fibration, and
- explore the importance of the Hopf fibration in the study of 3-manifolds and higher homotopy groups.

Theoretical Computer Science Seminar
Friday, February 6, 11:10-12:00p
CSE 3941
Andrey Goder (UM)
Incremental Cycle Detection, Topological Ordering, and Strong Component Maintenance

Incremental Cycle Detection, Topological Ordering, and Strong Component Maintenance Bernhard Haeupler , Telikepalli Kavitha, Rogers Mathew, Siddhartha Sen, and Robert E. Tarjan We present two on-line algorithms for maintaining a topological order of a directed n-vertex acyclic graph as arcs are added, and detecting a cycle when one is created. Our first algorithm handles m arc additions in O(m^(3/2)) time. For sparse graphs (m/n = O(1)), this bound improves the best previous bound by a logarithmic factor, and is tight to within a constant factor among algorithms satisfying a natural locality property. Our second algorithm handles an arbitrary sequence of arc additions in O(n^(5/2)) time. For sufficiently dense graphs, this bound improves the best previous bound by a polynomial factor. Our bound may be far from tight; we conjecture that the algorithm actually runs in O(n^2 log n) time. A completely different algorithm running in ?(n^2 log n) time was given recently by Bender, Fineman, and Gilbert. We extend both of our algorithms to the maintenance of strong components, without affecting the asymptotic time bounds.

Applied and Interdisciplinary Mathematics Seminar
Friday, February 6, 3:10-4:00pm
1084 EH
Richard Kollar (UM)
A Mathematical Model for Heat Damage of Cells

Did you ever wonder how much you're going to burn yourself if you touch a hot plate with your finger? Or how long can a firefighter stay in an extremely hot environment wearing a particular protective gear? We investigate damage to living cells due to external heating particularly relevant to skin burns due to a contact with a hot surface but also applicable to other types of heat damage. Along with a criticism of the traditional approach to this problem we derive a very novel model for heat damage for a general class of chemical kinetic systems. Based on this results, we identify a fundamental underlying dynamical system and build a simple phenomenological model that shows a good agreement with experimental data.
This is a joint work with Sabino Pietrangelo (a former undergraduate student at U Michigan).