

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

September 18th – September 24th

Monday, September 18

- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- David Speyer (UM) *Periods of Elliptic Curves and Hypergeometric Functions* --- 3866 EH
- 3:10-4:30pm **Arithmetic/Number Theory Seminar** --- Trevor Wooley (UM) *Waring's problem in function fields* --- 4096 EH
- 4:10-5:00pm **Several Complex Variables Seminar** --- Rüdiger Braun (Heinrich-Heine Universität, Düsseldorf) *Phragmen-Lindelöf conditions and limit varieties* --- 3096 EH
- 4:10-5:00pm **Differential Equations** --- Misha Perepelitsa (Vanderbilt U) *Weak Solutions to the Multidimensional Compressible Navier Stokes Equations* --- 3866 EH
- 4:10-6:00pm **Group Theory/Lie Theory Seminar** --- Ulrich Meierfrankenfeld (MSU) *The Structure Theorem and its Spinoffs* --- 4088 EH
- 4:10-6:00pm **Geometry & Physics** --- Not meeting this week --- 3088 EH

Tuesday, September 19

- 12:10-1:00pm **Student Algebraic Geometry Seminar** --- Kevin Tucker (UM) *GAGA, part II* --- 1068 EH
- 2:10-3:00pm **Geometry Seminar** --- Not meeting this week --- 4088 EH
- 3:10-4:00pm **Algebra Seminar** --- Not meeting this week --- 3096 EH
- 3:10-4:00pm **Complex Analysis Seminar** --- Not meeting this week --- 3088 EH
- 4:10-5:00pm **Colloquium (Alexander Ziwet Lectures)** --- Jerrold Marsden (CA Inst. of Technology) *Invariant Manifolds and Coherent Structures* --- 1360 EH

Wednesday, September 20

- 3:10-4:00pm **Student Arithmetic Seminar** --- Craig Spencer (UM) *Applications of the Circle Method* --- 3866 EH
- 3:10-4:00pm **Special Seminar** --- Steve Bleiler (Portland State U) *Quantum bluffing in entangled poker – An introduction to quantum game theory* --- 2866 EH
- 3:10-4:00pm **Student AIM Seminar** --- Geri Izbicki (UM) *Ode to Peter Lax* --- 3096 EH
- 3:10-5:00pm **Geometric Function Theory Seminar** --- Jang-Mei Wu (U of IL & UM) *Isotropic Doubling Measures and Quasiconformal Jacobians* --- 4096 EH
- 3:30-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Feng Rong (UM) *Analytic Transformations of C^n tangent to the identity* --- 4088 EH
- 4:10-5:00pm **Student Analysis Seminar** --- Not meeting this week --- 3866 EH
- 4:10-5:00pm **Colloquium (Alexander Ziwet Lectures)** --- Jerrold Marsden (CA Inst. of Technology) *Discrete Mechanics, Variational Integrators & Optimization* --- 1360 EH
- 5:10-6:30pm **Algebraic Geometry Seminar** --- Aaron Bertram (U of Utah) *Pi-stability: or how I learned to stop worrying and love the derived category* --- 3088 EH

Thursday, September 21

- 3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Ahmet Duran (UM) *Computational Parameter Optimization and Differential Equations for Stock Markets* --- 3088 EH
- 3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Continuous closure, continued* --- 3096 EH
- 3:10-4:00pm **Topology Seminar** --- Igor Kriz (UM) *What do we know about the moduli space of conformal field theories?* --- 4096 EH
- 3:10-5:00pm **Analysis Study Seminar** --- Juha Heinonen (UM) *Extending Lipschitz functions via random metric partitions (after Lee and Naor)...continued* --- 2866 EH
- 4:10-5:30pm **Workshop on applying for tenure track jobs** --- 3088 EH
- 4:10-5:00pm **Math Club (Undergraduate Mathematics Colloquium)** --- Steven Bleiler (Portland State U) *Quit Work, Play Poker, Sleep till Noon* --- 1324 EH
- 4:10-5:00pm **Student Combinatorics** --- Mark Conger (UM) *Refined Eulerian Numbers* ---3866 EH
- 4:10-5:00pm **Colloquium (Alexander Ziwet Lectures)** --- Jerrold Marsden (CA Inst. of Technology) *A Plethora of Geodesics on Lie Groups* --- 1360 EH
- 4:10-5:30pm **Logic Seminar** --- Carl Mummert (UM) *Introduction to subsystems of second-order arithmetic and reverse mathematics* --- 3096 EH
- 5:00-7:00pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

Friday, September 22

- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** ---Paul Milewski (Univ of WI) *Stability, Breaking Waves, and Mixing in Stratified Flows* ---1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- Kevin Tucker (UM) *Cech cohomology and a classification of vector bundles* --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Peter McNamara (Bucknell) *When are two skew Schur functions equal?* --- 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 SEPT. 18 – SEPT. 24, 2006

Topics in Algebraic Geometry Seminar

Monday, September 18, 3:10-4:00pm

3866 EH

David Speyer (UM)

Periods of Elliptic Curves and Hypergeometric Functions

I will describe how, in studying how changing the equation of a genus one curve effects its periods, one is naturally lead to study hypergeometric functions. This talk will hopefully be a prelude to Charles Cadman's talk in two weeks, where he will show how harder versions of this problem virtually require the hypergeometric technology.

Differential Equations

Monday, September 18, 4:10-5:00pm

3866 EH

Misha Perepelitsa (Vanderbilt U)

Weak Solutions to the Multidimensional Compressible Navier Stokes Equations

We consider motion of a compressible, viscous, flows as described by the Compressible Navier-Stokes equations. The existence of small energy, regular weak solutions in the whole space \mathbb{R}^N , $N=2,3$ was proved by David Hoff in 1995. In this talk we discuss the existence of solutions to the problem of motion of a gas in a bounded domain assuming a natural condition that the velocity vanishes at boundary. The main part will be given to the analysis of reflection of sound waves. It appears that this reflection is a singular phenomenon within the class of bounded densities. A weak solution will be constructed for which possible discontinuities in the density decay near the boundary.

Group Theory/Lie Theory Seminar

Monday, September 18, 4:10-6:00pm

4088 EH

Ulrich Meierfrankenfeld (MSU)

The Structure Theorem and its Spinoffs

An important step in the ongoing project to understand the finite groups of local characteristic p is the Structure Theorem. In my talk I will briefly discuss the Structure Theorem, but most of the time will be spent on a variety of theorems of independent interest, which we (Bernd Stellmacher, Gernot Stroth and myself) encountered during the proof of the Structure Theorem. Let G be a finite group, p a prime, and V a faithful $F_p G$ -module. We will discuss: (1) the Fitting submodule of V , an analogue of the generalized Fitting subgroup of G ; (2) nearly quadratic $2F$ -modules; (3) $2F$ -stability; (4) the J -Module Theorem; and (5) the Other $P(G,V)$ Theorem, a weaker version of the J -Module Theorem. Only (4) requires a K -group assumption for its proof.

Special Seminar
Wednesday, September 20, 3:10-4:00pm
2866 EH

Steve Bleiler (Portland State U)

Quantum bluffing in entangled poker – An introduction to quantum game theory

Computers and networks that exploit the properties of quantum mechanics will have capabilities far exceeding those of the conventional computing environment. The encryption of data, the searching of databases, and even the play of simple games such as on-line poker will undergo profound changes when implemented in a quantum environment. This is because players who communicate their strategic choices via quantum channels can put their strategic choices in superposition, and thus have access to a vastly enlarged selection of strategic choices as compared to that available to players communicating via classical channels. For some simple games, it is enough that one player have access to these quantum strategies when the other does not to ensure the first player's certain victory.

Yet for most two-player games, mere access to quantum strategies is merely an expensive way to implement what game theorists call mixed strategies. Strategic choices in a mixed strategy are determined randomly by the individual players with specific probabilities. Accessing the larger collection of quantum strategies in this circumstance requires the utilization of a fundamental phenomenon of the quantum environment, that of entanglement. Via a "quaternionization" of an entangled version of two player games, S. Landsburg has shown that new "solutions" to these games present themselves and that these "solutions" that perform better than the "solutions" available to players of the classical version. For example, for a simplified form of "heads up" poker, "quantum" bluffing is always more profitable than bluffing "classically", and even is profitable when classical bluffing is not!

This seminar will review the above and report on a newly developed "octonionization" of entangled three player quantum games. This construction generalizes Landsburg's two player construction and promises to yield corresponding results in the three player situation.

Geometric Function Theory Seminar
Wednesday, September 20, 3:10-5:00pm
4096 EH

Jang-Mei Wu (U of IL & UM)

Isotropic Doubling Measures and Quasiconformal Jacobians

We consider two problems: the doubling-quasisymmetry relation in space and the quasiconformal Jacobian weights. We discuss their connection, recent results and open questions.

Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, September 20, 3:30-5:30pm
4088 EH

Feng Rong (UM)

Analytic Transformations of C^n tangent to the identity

An analytic transformation f in C^n is said to be tangent to the identity (at the origin O), if $df_O = I_n$. Hakim showed that for an analytic transformation of C^n tangent to the identity, of degree v and with a non-degenerate characteristic direction $[v]$, there exist $v-1$ "parabolic curves" tangent to $[v]$. Hakim also took a closer look at the "characteristic matrix" A associated with a non-degenerate characteristic direction. She shows that when A has some eigenvalues with positive real parts, one can "fatten" the "parabolic curves" to be higher dimensional "parabolic manifolds". Furthermore, when the analytic transformation in consideration is a global isomorphism, the "attracting basins" associated with these "parabolic manifolds" are Fatou-Bieberbach domains.

Financial/Actuarial Mathematics Seminar
Thursday, September 21, 3:10-4:00pm
3088 EH

Ahmet Duran (UM)

Computational Parameter Optimization and Differential Equations for Stock Markets

We combine an implementation of a state-of-the-art optimization algorithm and a system of nonlinear differential equations to describe price dynamics. Given an n -day period of market price (MP) and net asset value (NAV) from day i to day $i+n-1$, we obtain four optimal parameters in the differential equations derived by Caginalp by using a nonlinear computational optimization technique. We then solve the initial value problem to predict MP and return on day $i+n$ or later. We provide out-of-sample prediction that is more successful than random walk.

Commutative Algebra Seminar
Thursday, September 21, 3:10-4:00pm
3096 EH

Mel Hochster (UM)

Continuous closure, continued

Following Holger Brenner, we discuss the following question: given f, f_1, \dots, f_m in the polynomial ring in n variables over the complex numbers (and in somewhat more general situations), when can one write $f = G_1 f_1 + \dots + G_m f_m$, where the G_i are only required to be continuous? In particular, we discuss a purely algebraic condition that is necessary. It is not known whether the condition is sufficient. This question leads to a closure operation on ideals.

Topology Seminar
Thursday, September 21, 3:10-4:00pm
4096 EH

Igor Kriz (UM)

What do we know about the moduli space of conformal field theories?

I will discuss a topic which originally belongs to physics, but recently got some attention in algebraic topology (for reasons I may briefly outline). In particular, it is believed that to each Calabi-Yau 3-fold there is assigned a conformal field theory known as its σ -model: these theories are prime candidates for string vacua in physics. Yet, the theories were never constructed rigorously mathematically. In this talk, I will discuss some evidence *against* the conjectured picture, i.e. evidence that the σ -models may not generically exist as conformal field theories in the mathematical axiomatic sense, after all. (joint work with Hao Xing)

Analysis Study Seminar
Thursday, September 21, 3:10-5:00pm
2866 EH

Juha Heinonen (UM)

Extending Lipschitz functions via random metric partitions (after Lee and Naor)...continued

I will discuss recent work by J. Lee and A. Naor (Inventiones 2005), where they construct Lipschitz extensions of functions from doubling subsets of arbitrary metric spaces into Banach spaces by using "random partitions of unity".

Math Club (Undergraduate Mathematics Colloquium)
Thursday, September 21, 4:10-5:00pm
1324 EH

Steven Bleiler (Portland State U)

Quit Work, Play Poker, Sleep till Noon

Ever notice in some "good" poker games how the "weakest" players seem to always come out on top, while the "strong" players do poorly and mutter about how "lucky" their opponents are? This is no accident! There are powerful game theoretic principles at work here, ones that, on the surface at least, appear to contradict Sklansky's famous Fundamental Theorem of Poker. We'll review these principles, exploring a bit of mathematical game theory (which is really not so much about games as it is about making correct decisions) along the way. Then we'll investigate their application, and finally develop the strategic adjustments a good player must make in order to prevail over one's opponents in this environment.

Logic Seminar
Thursday, September 21, 4:10-5:30pm
3096 EH

Carl Mummert (UM)

Introduction to subsystems of second-order arithmetic and reverse mathematics

This talk is an introduction to the theory of second order arithmetic and its subsystems. The closely related program of Reverse Mathematics seeks to determine which set existence principles are required to prove well known theorems of mathematics. The talk will emphasize conservation results and the relationship to classical computability theory.

Applied and Interdisciplinary Mathematics Seminar
Friday, September 22, 3:10-4:00pm
1084 EH
Paul Milewski (U of WI)
Stability, Breaking Waves, and Mixing in Stratified Flows

The shallow water or hydraulic limit for a single layer of fluid is well understood. All waves eventually break, and, at shocks, conservation of mass and momentum completely define the hydraulic jump. The energy equation gives, a posteriori, the rate at which "internal" energy (mostly in the form of small scale turbulence) is generated. For the case of two-layer shallow water, even the evolution of smooth solutions was not completely understood since there is the possibility for the system to be elliptic, a remnant of the Kelvin-Helmholtz instability. We first show that these flows are nonlinearly stable: smooth solutions never cross into the elliptic domain. Then, we consider shocks at the interface of miscible fluids - a problem of geophysical importance in the atmosphere and ocean. We require an additional postulate that would yield the mixing rate at the shock: one can imagine that the energy dissipated at the shock can now flow both into small scale turbulence and into mixing the fluid, but the partition between these sinks of macroscopic energy is unknown. We discuss two possibilities for deriving the additional constraint on the problem: kinematics and entropy maximization. We show that these are in fact equivalent and yield upper bounds on the mixing rates.

Combinatorics
Friday, September 22, 4:10-5:00pm
3866 EH
Peter McNamara (Bucknell)
When are two skew Schur functions equal?

We present a single operation for constructing skew diagrams whose corresponding skew Schur functions are equal. This combinatorial operation naturally generalizes and unifies all results of this type to date. Moreover, our operation suggests a closely related condition that we conjecture is necessary and sufficient for skew diagrams to yield equal skew Schur functions.