

Fall 2008
University of Michigan-Department of Mathematics
<http://www.math.lsa.umich.edu/seminars/index.shtml>
Ann Arbor, MI 48109-1043

September 8th – September 14th

Monday, September 8

- 3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Organizational Meeting --- 2866 EH
3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- Marty Weissman (Santa Cruz)
Metaplectic Tori --- 4096 EH
4:10-5:00pm **Applied and Interdisciplinary Mathematics (Special Seminar)** --- Wooyoung Choi (NJ
Inst. Of Tech) *Kelvin-Helmholtz Instability of Large Amplitude Internal Solitary Waves and
a Regularized Model* --- 3088 EH
4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- Sonmez Sahutoglu
(UM) *Compactness of Hankel Operators and Analytic Discs in the Boundary of
Pseudoconvex Domains* --- 3096 EH
5:15-6:30pm **Teaching Mathematics** --- TBA --- 3096 EH

Tuesday, September 9

- 2:10-3:00pm **"What is ... " Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Juan Souto (UM) *A remark on Morita's non-lifting theorem* ---
4096 EH
3:10-4:00pm **Algebra Seminar** --- Not meeting this week --- 3096 EH
4:10-5:00pm **Colloquium** --- Not meeting this week --- 1360 EH

Wednesday, September 10

- 3:10-4:00pm **Geometric Function Theory Seminar** --- Tim Ferguson (UM) --- *Continuity of Extremal
Elements in Uniformly Convex Spaces* --- 4096 EH
3:10-4:00pm **Student Representation Theory Seminar** --- TBA --- 3096 EH
4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Liz
Vivas (UM) *Fatou Bieberbach Domain not intersecting two complex lines* --- 4088 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Jason Starr (Stony Brook) *Rational simple
connectedness and Serre's "Conjecture II"* --- 3088 EH

Thursday, September 11

- 3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Not meeting this week --- 3088 EH
3:10-4:00pm **Commutative Algebra Seminar** --- Tigran Ananyan (UM) *Introduction to Hilbert-Kunz
multiplicity* --- 3096 EH
3:10-4:00pm **Topology Seminar** --- TBA --- 4088 EH
4:10-5:00pm **Differential Equations** --- Volker Elling (UM) *Counterexamples to the sonic and
detachment criteria* --- 4088 EH
4:10-5:00pm **Math Club** --- Stephen DeBacker (UM) *Fermat's Christmas Theorem* --- 2nd floor Nesbitt
Common Room
4:10-5:00pm **Student Combinatorics** --- Kelli Talaska (UM) *A generalization of Lindstrom's Lemma,
via planar networks and the real Grassmannian* --- 3088 EH
4:10-6:00pm **Geometry & Physics** --- Marc Krawitz (UM) *Landau-Ginzburg mirror symmetry* --- 4088
EH
4:10-6:00pm **RTG Study Seminar** --- Juan Souto (UM) *Small eigenvalues of the Laplacian* --- 3866
EH

Friday, September 12

- 10:10-11:00am **Student Quadratic Forms Seminar** --- TBA --- 4096 EH
1:10-2:00pm **Student AIM Seminar** --- Introduction and Planning Meeting --- 3096 EH

Friday, September 12 ... continued

- 3:10-4:00pm **Algebraic Geometry Seminar (Special Seminar)** --- Brian Conrad (Stanford) *Pseudo-reductive groups* --- 3088 EH
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Joe Conlon (UM) *The Becker-Döring and Lifschitz-Slyozov-Wagner Equations* --- 1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- William Giganc (UM) TBA --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Not meeting this week --- 3866 EH
- 4:10-5:30pm **Grant Writing Panel Discussion** --- B844 EH

ABSTRACTS FOR THE WEEK OF SEPT. 8 – SEPT. 14, 2008

**Several Complex Variables Seminar
Monday, September 8, 4:10-5:00pm
3096 EH**

Sonmez Sahutoglu (UM)

Compactness of Hankel Operators and Analytic Discs in the Bounday of Pseudoconvex Domains

Using several complex variables techniques, we want to investigate the interplay between the geometry of the boundary and compactness of Hankel Operators. Let β be a function smooth up to the boundary on a smooth bounded pseudoconvex domain $\Omega \subset \mathbb{C}^n$. We show that if Ω is convex or the Levi form of $\partial\Omega$ is of rank at least $n-2$ then compactness of the Hankel operator H_{β} implies that β is holomorphic "along" analytic discs in the boundary. Furthermore, when Ω is convex in \mathbb{C}^2 , we show that the condition on β is necessary and sufficient for compactness of H_{β} . This is a joint work with Zeljko Cuckovic.

**Group Theory/Lie Theory/Number Theory Seminar
Monday, September 8, 3:10-5:00pm
4096 EH**

**Marty Weissman (Santa Cruz)
*Metaplectic Tori***

In 1968, Langlands classified the smooth characters of the k -points of a torus T , when k is a local field and T is an algebraic torus over k . This generalization of class field theory set the stage for the formation of the local Langlands conjectures, including the construction of the L -group. In this lecture, we attempt to set the stage for a local metaplectic Langlands program, by generalizing Langlands 1968 theorem to "metaplectic tori". During the first part of the talk, Langlands' theorem will be introduced, a precise and motivated definition of "metaplectic tori" will be given, and the generalization of Langlands theorem to metaplectic tori will be presented. Time permitting, during the second part of the talk, the category of metaplectic groups will be discussed in more detail, and some pieces of a local metaplectic Langlands conjecture will be formulated.

Applied and Interdisciplinary Mathematics (Special Seminar)

Monday, September 8, 4:10-5:00pm

3088 EH

Wooyoung Choi (NJ Inst. Of Tech)

Kelvin-Helmholtz Instability of Large Amplitude Internal Solitary Waves and a Regularized Model

Packets of nonlinear internal waves have been observed in many coastal regions around the world. These wave packets typically generated by the interaction of stratified tidal flow with topographic features are highly nonlinear and their wave amplitudes often exceed 100 m. In this work, we study large amplitude internal solitary waves in a system of two constant density layers using a strongly nonlinear long wave model. While steady solitary wave solutions of the model show excellent agreement with numerical solutions of the Euler equations and laboratory experiments, a local stability analysis reveals that the time-dependent inviscid model suffers from the Kelvin-Helmholtz instability due to a tangential velocity discontinuity across the interface. To suppress this undesirable short wave instability that is often absent in real experiments, an attempt is made to regularize the model by modifying the short wave behavior of the dispersion relation and introducing the effect of viscosity.

Geometry Seminar

Tuesday, September 9, 3:10-4:00pm

4096 EH

Juan Souto (UM)

A remark on Morita's non-lifting theorem

Morita proved that the mapping class group does not lift to the group of diffeomorphisms of the surface. The goal of this talk is to give a simple proof of this fact. This is a joint work with Mladen Bestvina and Tom Church.

Geometric Function Theory Seminar

Wednesday, September 10, 3:10-4:00pm

4096 EH

Tim Ferguson (UM)

Continuity of Extremal Elements in Uniformly Convex Spaces

I will discuss the problem of finding the extremal element for a linear functional over a uniformly convex Banach space. I will show that a unique extremal element exists and depends continuously on the linear functional, and vice-versa. Also, I will discuss a theorem of Ryabykh which says that for any linear functional on a uniformly convex Bergman space with kernel in a certain Hardy space, the extremal function belongs to the corresponding Hardy space. I will outline a proof of this using results from the talk.

RTG Working Seminar in Several Complex Variables and Complex Dynamics

Wednesday, September 10, 4:10-5:00pm

4088 EH

Liz Vivas (UM)

Fatou Bieberbach Domain not intersecting two complex lines

It is an open question if there exists a biholomorphic map from \mathbb{C}^2 into $\{z \neq 0\} \subset \mathbb{C}^2$.

We will talk about what is known and potential techniques to solve this problem.

Algebraic Geometry Seminar
Wednesday, September 10, 4:10-6:00pm
3088 EH
Jason Starr (Stony Brook)
Rational simple connectedness and Serre's "Conjecture II"

This is joint work with A. J. de Jong and Xuhua He. Rational simple connectedness is to simple connectedness as rational connectedness is to path connectedness: one replaces continuous maps from the unit interval by morphisms from the projective line. Using this notion, there is an analogue of the result in topology that a simply connected fibration over a 2-dimensional base has a continuous section. Using this analogue, and a strategy of Philippe Gille, we prove the split case of Serre's "Conjecture II" in non-Abelian Galois cohomology for function fields: every torsor for a connected, simply connected, semisimple algebraic group over a function field of a surface is trivial. In fact work of Merkurjev -- Suslin, Bayer-Fluckiger -- Parimala, Colliot-Thélène -- Gille -- Parimala and Gille reduced the full conjecture to the split case for function fields, so this settles Serre's "Conjecture II" for function fields.

Differential Equations
Thursday, September 11, 4:10-5:00pm
4088 EH
Volker Elling (UM)
Counterexamples to the sonic and detachment criteria

When waves meet an oblique wall, they usually undergo regular reflection. But for shock waves there are two kinds of reflection, weak and strong. Moreover around 1875 Ernst Mach discovered another type of reflection, now named after him. Ever since, researchers have tried to find simple conditions predicting which type of reflection appears in particular circumstances. The most important candidates are the detachment, sonic, and von Neumann criteria.

We prove counterexamples showing that both the sonic and detachment criterion are not universally correct. In particular there is a large variety of regular weak reflections with a transonic shock. To answer these questions, techniques from nonlinear elliptic theory are crucial.

Geometry & Physics
Thursday, September 11, 4:10-6:00pm
4088 EH
Marc Krawitz (UM)
Landau-Ginzburg mirror symmetry

Landau-Ginzburg theories arise in the study of superconformal field theories in physics, and feature significantly in some statements of Mirror Symmetry. In a recent paper, Fan, Jarvis and Ruan construct a so-called 'quantum singularity theory' for these Landau-Ginzburg theories, putting the Mirror Symmetry statements on a firm mathematical footing, and compute the quantum singularity theory for the simple singularities of type A-D-E. I will talk about similar computations for Arnol'd's 14 exceptional singularities, and how they (conjecturally) fit in to a more general framework.

Math Club
Thursday, September 11, 4:10-5:00pm
2nd floor Nesbitt Common Room
Stephen DeBacker (UM)
Fermat's Christmas Theorem

Fermat's Christmas Theorem (25 December, 1640) is the incredibly beautiful statement that an odd prime may be written as the sum of two squares if and only if it is one more than a multiple of four. As with his famous last theorem, Fermat stated, but did not prove, this theorem. Many of the greats (e.g., Euler, Gauss, Dedekind) produced proofs of the Christmas Theorem. In this talk, we will discuss an approach to the problem via that most elementary of all number-theoretic concepts: the Euclidean Algorithm.

Student Combinatorics
Thursday, September 11, 4:10-5:00pm
3088 EH
Kelli Talaska (UM)
A generalization of Lindstrom's Lemma, via planar networks and the real Grassmannian

Lindstrom's Lemma, popularized by Gessel and Viennot, is a classical result which relates certain determinants to enumerations of non-crossing path families in acyclic directed graphs. In this talk, we will give a natural generalization to directed graphs which are not necessarily acyclic, based on Postnikov's work establishing a relationship between certain planar networks and points in the appropriate real Grassmannian. The talk will be elementary, with plenty of examples.

RTG Study Seminar
Thursday, September 11, 4:10-6:00pm
3866 EH
Juan Souto (UM)
Small eigenvalues of the Laplacian

I will discuss some older results due to Buser about eigenvalues of the Laplacian of hyperbolic surfaces and then explain the proof of a theorem of Otal asserting that $\lambda_{2g-2} > 1/4$ for a closed hyperbolic surface of genus g . This result is optimal.

Student AIM Seminar
Friday, September 12, 1:10-2:00pm
3096 EH
Introduction and Planning Meeting

The student AIM seminar will have its first meeting Friday, 1-2 p.m. in 3096 EH. We will be discussing potential topics for the new semester. The format is different from last year. Our theme for this semester is the "Applied Mathematician's Toolbox." We will be discussing topics and techniques frequently used by applied mathematicians; ones that span several fields. Please bring some ideas that you are interested in discussing or learning more about. If you are interested in any field of applied mathematics, please feel free to attend. All are welcome.

Algebraic Geometry Seminar (Special Seminar)

Friday, September 12, 3:10-4:00pm

3088 EH

Brian Conrad (Stanford)

Pseudo-reductive groups

One of the most beautiful topics in pure mathematics is the structure theory of connected reductive algebraic groups over general fields. This is especially nice over separably closed fields, where it is given in terms of root systems.

Over general perfect fields (such as \mathbb{Q}) one can often reduce questions involving general smooth connected affine algebraic groups to the reductive case, but this is not at all possible over imperfect fields, such as function fields of curves over finite fields. This leads one to seek a weakening of reductivity (equivalent to it over perfect fields) for which one can nonetheless develop a useful structure theory.

The right weakening, called pseudo-reductivity, was introduced and studied by Borel and Tits, but they were unable to develop a classification suitable for arithmetic applications.

In joint work with O. Gabber and G. Prasad we have established such a classification (away from characteristic 2 for now). I will explain some concrete problems that motivate the desired to study pseudo-reductive groups, and show a number of examples to illustrate various aspects of the classification. The precise form of the classification theorem will also be given, and depending on the time that remains I may say a few things about the proof. Arithmetic applications will be given in another seminar talk on Monday.

Applied and Interdisciplinary Mathematics Seminar

Friday, September 12, 3:10-4:00pm

1084 EH

Joe Conlon (UM)

The Becker-Döring and Lifschitz-Slyozov-Wagner Equations

The Becker-Döring (B-D) equations describe a mean field approximation for a many body system in relaxation to equilibrium. The two B-D equations determine the time evolution of the density $c(L,t)$ of particles with mass L , $L=1,2,\dots$. One of the equations is a discretized linear diffusion equation for $c(L,t)$, and the other is a non-local constraint equivalent to mass conservation. Existence and uniqueness for the B-D system was established in the 1980's by Ball, Carr and Penrose. Research in the past decade has concentrated on understanding the large time behavior of solutions to the B-D system. This behavior is characterized by the phenomenon of "coarsening", whereby excess density is concentrated in large particles with mass increasing at a definite rate. An important conjecture in the field is that the coarsening rate can be obtained from a particular self-similar solution of the simpler Lifschitz-Slyozov-Wagner (LSW) system. In this talk we shall discuss the B-D and LSW equations, and some recent progress by the speaker and others towards the resolution of this conjecture.