

Winter 2008  
University of Michigan-Department of Mathematics  
<http://www.math.lsa.umich.edu/seminars/index.shtml>  
Ann Arbor, MI 48109-1043  
**March 10th – March 16th**

**Monday, March 10**

- 3:10-4:00pm **Student Analysis Seminar** --- TBA --- 3866 EH  
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Kyle Hofmann (UM) *Logarithmic differentials* --- 2866 EH  
3:10-4:00pm **Working Group in Integrable Systems and Asymptotics** --- Robert Buckingham (UM) *Universality Limits for Spectra of Random Matrices* --- 3088 EH  
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Jim Cogdell (OSU) *A report on functoriality* --- 4096 EH  
4:10-5:00pm **Several Complex Variables Seminar** --- Jae-Seong Cho (Purdue) *Sharp Subelliptic Estimates for Special Domains* --- 3096 EH  
4:10-6:00pm **Geometry & Physics** --- TBA --- 4088 EH  
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

**Tuesday, March 11**

- 2:10-3:00pm **"What is ... " Seminar** --- Mattias Jonsson (UM) *What is ... holomorphic dynamics?* --- 3096 EH  
3:10-4:00pm **Algebra Seminar** --- TBA --- 3096 EH  
3:10-4:00pm **Geometry Seminar** --- Jeremy Copeland (MIT) *Surface braids, Higgs fields, and monodromy representations* --- 4088 EH  
3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH  
4:10-5:00pm **Colloquium** --- Dusa McDuff (SUNY Stony Brook) *Gromov-Witten invariants and Hamiltonian dynamics* --- 1360 EH  
5:00-6:00pm **Social Hour** --- Upper Atrium

**Wednesday, March 12**

- 3:10-4:00pm **Geometric Function Theory Seminar** --- TBA --- 4096 EH  
3:10-4:00pm **Student Representation Theory/Lie Theory Seminar** --- TBA --- 3088 EH  
3:10-4:00pm **Student Arithmetic Seminar** --- Johnson Jia (UM) *Tate's Thesis* --- 3866 EH  
3:10-4:00pm **Student AIM Seminar** --- Jared Whitehead (UM) *The Dam Problem and its Dam Consequences* --- 3096 EH  
4:10-5:00pm **Complex Analysis Seminar** --- Not meeting this week --- 3096 EH  
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- TBA --- 4088 EH  
4:10-6:00pm **Algebraic Geometry Seminar** --- Johannes Nicaise (Univ. Lille 1) *Complex singularities and non-archimedean geometry* --- 3088 EH

**Thursday, March 13**

- 3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Phantom homology (cont.)* --- 3096 EH  
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Stefan Weber (Cornell) *Optimal Portfolio Choice with Limited Downside Risk* --- 3088 EH  
3:10-4:00pm **Topology Seminar** --- Anna Lenzhen (UM) TBA --- 4096 EH  
4:10-5:00pm **Differential Equations** --- Tao Luo (Georgetown) *Transonic Shock Solutions for a System of Euler-Poisson Equations* --- 4088 EH  
4:10-5:00pm **Math Club** --- Paul Siegel (UM) *Birkhoff's Ergodic Theorem* --- 2<sup>nd</sup> Floor Nesbitt Common Room  
4:10-5:00pm **Student Combinatorics** --- Kelli Talaska (UM) *k-Schur Functions II* --- 3866 EH  
4:10-5:30pm **Logic Seminar** --- TBA --- 3096 EH  
4:10-6:00pm **Study Seminar** --- TBA --- 3088 EH

<b>Friday, March 14</b>
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- 10:50-12:00pm **EECS Theory Seminar** --- Ye Du (UM) *Leontief Economies Encode Nonzero Sum Two-Player Games* --- CSE 2725
- 2:10-3:00pm **Topics in Geometry** --- Dan Burns (UM) *Seiberg-Witten-Floer homology for a contact 3-manifold: identifications for large  $r$*  --- 3866 EH
- 3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Fabian Heitsch (UM) TBA --- 1084 EH
- 3:10-4:00pm **Student Geometry/Topology** --- TBA --- 3096 EH
- 4:10-5:00pm **Combinatorics** --- Anders Jensen (TU Berlin) *The "reverse search" property of Gröbner fans* --- 3866 EH

### EVENTS THIS WEEK

#### Graduate Student Recruitment Weekend March 14 & 15, 2008

#### ABSTRACTS FOR THE WEEK OF MAR. 10– MAR. 16, 2008

**Topics in Algebraic Geometry Seminar**  
**Monday, March 10, 3:10-4:00pm**  
2866 EH  
**Kyle Hofmann (UM)**  
*Logarithmic differentials*

We'll discuss the definition and basic properties of differentials for logarithmic schemes. These are mostly analogous to ordinary differentials. In some cases they are identical to the ordinary differentials, and we'll give a criterion for when this is so. But they aren't always identical to the ordinary differentials: We'll compute the relative differentials for a morphism of affine toric varieties, and as a consequence, it will turn out that the map  $x \rightarrow x^n$  is logarithmically unramified when the characteristic of the ground field does not divide  $n$ . We'll also describe the case of a normal crossing divisor.

**Number Theory and Representation Theory Seminar**  
**Monday, March 10, 3:10-5:00pm**  
4096 EH  
**Jim Cogdell (OSU)**  
*A report on functoriality*

I will review past results and describe new results in the program of establishing functoriality to  $GL(n)$  via the converse theorem. Recently, with P-S and Shahidi, we have established the stability of certain gamma factors for quasi-split groups  $G$  under highly ramified twists. This is used in the proof of functoriality from  $G$  to  $GL(n)$  to finesse the lack of a full Local Langlands Conjecture for  $G$ . I will review the ideas in the proof of functoriality from  $G$  to  $GL(n)$  via the converse theorem to place our stability result in context. Then I will outline what results follow and what we expect to follow from this stability in terms of functoriality and global and local applications. Finally time permitting, I would like to speculate on what we need to be looking at if we expect to push these methods further.

**Several Complex Variables Seminar**  
**Monday, March 10, 4:10-5:00pm**  
**3096 EH**  
**Jae-Seong Cho (Purdue)**  
***Sharp Subelliptic Estimates for Special Domains***

The largest possible value of the subelliptic gains on  $(0,1)$ -forms for general pseudoconvex domains of finite type are not well known except for some simple cases. It was known, due to David Catlin, that its upper bound is less than or equal to the reciprocal of the maximum order of contact of holomorphic curves to the boundary. I will show that for various types of Special domains this value is the largest one by constructing a family of plurisubharmonic functions near the boundary with large Hessian.

**“What is ... ” Seminar**  
**Tuesday, March 11, 2:10-3:00pm**  
**3096 EH**  
**Mattias Jonsson (UM)**  
***What is ... holomorphic dynamics?***

I will discuss some constructions and results from holomorphic dynamics, focusing on iteration problems in several complex variables.

**Geometry Seminar**  
**Tuesday, March 11, 3:10-4:00pm**  
**4088 EH**  
**Jeremy Copeland (MIT)**  
***Surface braids, Higgs fields, and monodromy representations***

We introduce a "one-dimensional" version of the "zero-dimensional" definition of Weyl groups, which describes monodromy of families of surfaces with various symmetries. We study this system from the perspective of representations of (generalizations of) surface braid groups. Hopefully we can discuss how this picture describes the moduli space of Higgs fields and how it relates to the Electric/Hoof/Hecke eigensheaf side of the geometric Langlands program. The only assumption should be a tiny awareness of line bundles over curves.

**Colloquium**  
**Tuesday, March 11, 4:10-5:00pm**  
**1360 EH**  
**Dusa McDuff (SUNY Stony Brook)**  
***Gromov-Witten invariants and Hamiltonian dynamics***

We will describe some recently discovered relations between the properties of the quantum cohomology ring  $QH$  of a symplectic manifold and its group  $Ham$  of Hamiltonian symplectomorphisms. The main tool is the Seidel representation of the fundamental group of  $Ham$  in the group of units of  $QH$ . The talk will be aimed at a general audience.

**Algebraic Geometry Seminar**  
**Wednesday, March 12, 4:10-6:00pm**  
**3088 EH**  
**Johannes Nicaise (Univ. Lille 1)**  
***Complex singularities and non-archimedean geometry***

The Milnor fibration is a powerful tool to analyze the singularities of complex analytic maps. I'll explain how its construction can be mimicked in algebraic geometry using the framework of formal schemes and rigid varieties. We called the resulting object the "analytic Milnor fiber": it is a rigid analytic variety over the non-archimedean field of complex Laurent series, and many of its invariants have a natural interpretation in singularity theory (nearby cycles and monodromy, Gauss-Manin connections, mixed Hodge structures, motivic zeta functions, log-canonical thresholds,...).

In the first part of the talk, I'll explain the construction of the classical Milnor fibration, and I will try to give some intuition on the definition of the analytic Milnor fiber; I will not assume any background in non-archimedean geometry. In the second part, I'll show how several invariants of the analytic Milnor fiber can be interpreted in terms of motivic zeta functions and classical singularity theory.

**Commutative Algebra Seminar**  
**Thursday, March 13, 3:10-4:00pm**  
**3096 EH**  
**Mel Hochster (UM)**  
***Phantom homology (cont.)***

This set of several lectures will deal with phantom homology. The idea is that one may have a complex such that the cycles are in the tight closure of boundaries. The homology at that spot is said to be "phantom." If one makes a base change to a ring, such as a regular ring, in which submodules are always tightly closed, the image of the homology of the complex vanishes. This technique leads to deep theorems that are difficult or, so far as we know, impossible to prove by other methods. Familiarity with the basic notions of tight closure theory will be assumed.

**Financial/Actuarial Mathematics Seminar**  
**Thursday, March 13, 3:10-4:00pm**  
**3088 EH**  
**Stefan Weber (Cornell)**  
***Optimal Portfolio Choice with Limited Downside Risk***

The measurement and management of the downside risk of portfolios is a key issue for financial institutions. The industry standard Value at Risk (VaR) shows serious deficiencies as a measure of the downside risk. It penalizes diversification in many situations and does not take into account the size of very large losses exceeding the value at risk. These problems motivated intense research on alternative static and dynamic risk measures. While axiomatic results are an important first step towards better risk management, an analysis of the economic implications of different approaches to risk management should not be neglected. Risk limits influence the behavior of economic agents -- and this impact is not captured by the classical analysis. The talk will discuss recent research on portfolio choice under risk constraints.

**Differential Equations**  
**Thursday, March 13, 4:10-5:00pm**  
**4088 EH**  
**Tao Luo (Georgetown U & Worcester Polytechnic Inst.)**  
***Transonic Shock Solutions for a System of Euler-Poisson Equations***

A boundary value problem for a system of Euler-Poisson equations modeling semiconductor devices or plasma is considered. The boundary conditions are supersonic on supersonic inflow and subsonic outflow. The purpose is to elucidate the role played by the electric field to the structure of solutions with transonic shocks. The existence, non-existence, uniqueness and non-uniqueness of solutions with transonic shocks are obtained according to the different cases of boundary data and physical interval length. Detailed structures of solutions are given. Shock locations are determined by the boundary data. Different phenomena are shown for the different situations when the density of fixed, positively charged background ions is in supersonic and subsonic regimes. This is a joint work with Zhouping Xin.

**Math Club**  
**Thursday, March 13, 4:10-5:00pm**  
**2<sup>nd</sup> Floor Nesbitt Common Room**  
**Paul Siegel (UM)**  
***Birkhoff's Ergodic Theorem***

Consider a gas inside of a closed container. Each molecule of the gas has a velocity, and one can consider both the average velocity of a single molecule in time as it flies around (the "time average") and the average velocity taken over all particles in the container at a given time (the "space average"). Birkhoff's ergodic theorem says that under mild realistic assumptions about the system, the time average for the vast majority of the molecules agrees with the space average of the whole system. I shall state and prove this theorem as a general statement about dynamical systems, informally developing the ideas from measure theory that I need along the way. In the remaining time I will provide some applications of the theorem to number theory and discuss how it can be used to fight crime!

**Student Combinatorics**  
**Thursday, March 13, 4:10-5:00pm**  
**3866 EH**  
**Kelli Talaska (UM)**  
***k-Schur Functions II***

This talk will build on Luis's introduction to  $k$ -Schur functions from last week. We will examine affine Stanley symmetric functions and their relationship to the  $k$ -tableaux used to characterize  $k$ -Schur functions. Stanley symmetric functions are used to study the number of reduced decompositions of words in the symmetric group; it turns out these are related to Schubert polynomials, which are used in the study of flag varieties. After a brief introduction to classical Stanley symmetric functions, we will get into affine Stanley symmetric functions, an analogue/generalization for the affine symmetric group.

**Combinatorics**  
**Friday, March 14, 4:10-5:00pm**  
**3866 EH**  
**Anders Jensen (TU Berlin)**  
***The "reverse search" property of Gröbner fans***

The Gröbner fan of a polynomial ideal  $I$  was defined by Mora and Robbiano in 1988. It is a collection of polyhedral cones indexing the reduced Gröbner bases of  $I$ . Independent of this definition Bayer and Morrison defined an essentially dual object: the state polytope of  $I$ . Indeed for any homogeneous ideal  $I$  a polytope can be constructed whose normal fan is the Gröbner fan of  $I$ . The "reverse search" technique by Avis and Fukuda is a clever, memoryless way of organizing the traversal of the edge graph of a polyhedron. In order to develop efficient algorithms for computing the Gröbner fan we may ask ourselves the following natural question: Is the Gröbner fan of any ideal the normal fan of a polyhedron? In this talk we show that the answer is no, but that the reverse search idea still applies. This is joint work with Komei Fukuda and Rekha Thomas.