Winter 2008
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
January 21st – January 27th

Monday, January 21

3:10-4:00pm **Student Analysis Seminar** --- TBA --- 3866 EH
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Not meeting this week --- 2866 EH
3:10-4:00pm **Working Group in Integrable Systems and Asymptotics** --- Not meeting this week --- 3088 EH
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Not meeting this week (MLK Day) --- 4096 EH
4:00-5:00pm **Dr. Marjorie Lee Browne Colloquium** --- Juan Meza (Lawrence Berkeley Nat'l Laboratory) *I Want to Be a (Computational) Mathematician* --- 1360 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Not meeting this week (MLK Day) --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- Not meeting this week --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

Tuesday, January 22

2:10-3:00pm "**What is … " Seminar** --- Peter Miller (UM) *What is … a soliton?* --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Tom Mestag (UM) *Routh reduction for Lagrangian systems with a non-Abelian symmetry group* --- 4088 EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- Kevin Tucker (UM) *Theta functions [D, 4.1, 4.3]* --- 3088 EH
4:10-5:00pm **Colloquium** --- Ingrid Daubechies (Princeton) *Muliscale Analysis of Vincent Van Gogh's paintings* --- 1360 EH

Wednesday, January 23

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** --- Craig Spencer (UM) *Diophantine Inequalities* --- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- TBA --- Room TBA
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Jean Ruppenthal (U of Bonn) *>L^p-obstructions for the ∂-equation on a cone with isolated singularity* --- 4088 EH
4:10-5:00pm **Algebraic Geometry Seminar (Part 1)** --- Jarod Alper (Stanford) *Good moduli spaces for Artin stacks* --- 3088 EH
5:10-6:00pm **Algebraic Geometry Seminar (Part 2)** --- Chanyang Xu (Princeton) *Degenerations of rationally connected varieties* --- 3088 EH

Thursday, January 24

3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Sergey Levendorskiy (U of Texas) *Wiener-Hopf factorization as a general method for valuation of real and American options* --- 3088 EH
3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Phantom homology* --- 3096 EH
3:10-4:00pm **Topology Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Differential Equations** --- Mohar Guha (UM) *Front Propagation in a Noisy, Nonsmooth, Excitable Medium* --- 4088 EH
4:10-5:00pm **Math Club** --- Loren Spice (UM) *Can you tell me the way to sum to A?* --- 2nd floor Nesbitt Common Room
4:10-5:00pm **Student Combinatorics** --- Dave Anderson (UM) *Schubert polynomials and Hessenberg varieties* --- 3866 EH

Thursday, January 24 …continued

4:10-6:00pm **Study Seminar** --- TBA --- 3088 EH

Friday, January 25

10:50-12:00pm **EECS Theory Seminar** --- Yaoyun Shi (UM) TBA --- CSE 3941

2:10-3:00pm **Topics in Geometry** --- Cagatay Kutluhan (UM) *Background and introduction to Seiberg-Witten and the Weinstein Conjecture* --- 3866 EH

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Jared Bronski (U of Illinois) *Krein Signatures for the Faddeev-Takhtajan Eigenvalue Problem* --- 1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Aaron Magid (UM) *Simultaneous Uniformization: Connections between Hyperbolic 3-Manifolds and Teichmuller Space* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Patricia Hersh (Indiana) *Regular cell complexes modeling Bruhat intervals* --- 3866 EH

4:10-5:00pm **Complex Analysis Seminar** --- TBA --- 4088 EH

EVENTS THIS WEEK

Dr. Marjorie Lee Browne Colloquium
(as part of the University of Michigan's Rev. Dr. Martin Luther King, Jr. Symposium)
Monday, January 21, 4:00-5:00pm
1360 EH
Juan Meza (Lawrence Berkeley National Laboratory)
I Want to Be a (Computational) Mathematician

Twenty years ago Halmos wrote a wonderful book entitled I Want to Be a Mathematician, describing his life as a mathematician, while also giving us a history of mathematics from the 1930s to the 1980s. I read his book while in graduate school and delighted in the stories and his perspectives on life as a mathematician. In this talk, I'd like to give my own perspective, beginning when I became interested in mathematics as an undergraduate to today, focusing on some recent work on new algorithms, massively parallel computers, and the application of both to some of today's most challenging problems. This combination of mathematics with computers has given rise to the field of computational mathematics, which has helped to advance computational science to the point that many people today now view it as the third pillar of science alongside experiments and theory. I will give examples of the power of computational mathematics drawn from my personal experiences and explain how mathematics amplifies scientific research. I will conclude with some thoughts on the future of computational and applied mathematics and what I see as the challenging new opportunities for helping science and society as a whole.

UPCOMING EVENTS

Ziwet Lectures
Feb. 5-7, 2008
Speaker: Curtis McMullen
Series Title: Dynamics and moduli spaces

Schedule:
Tuesday, February 5, 4:00-5:00pm --- Room TBA
Billiards and Teichmueller Theory

Wednesday, February 6, 4:00-5:00pm --- 1360 EH
Islands on algebraic surfaces

Thursday, February 7, 3:00-4:00pm --- Room 1360 EH
Topology of numbers

These talks will present progress and open problems at the interface between dynamical systems and moduli spaces of complex manifolds and Euclidean lattices.

Note: all talks will be accessible to a general audience, and none is a prerequisite for any other.

ABSTRACTS FOR THE WEEK OF JAN. 21– JAN. 27, 2008

"What is …" Seminar
Tuesday, January 22, 2:10-3:00pm
3096 EH
Peter Miller (UM)
What is … a soliton?

Norman Zabusky coined the word "soliton" in 1965 to describe a curious feature he and Martin Kruskal observed in their numerical simulations of the initial-value problem for a simple nonlinear partial differential equation. This talk will describe several of the aspects of solitons that have become important in pure and applied mathematics since their accidental discovery 40 years ago in a (by today's standards) primitive numerical experiment. In particular, a soliton is at once (i) a particular solution of one of many special "integrable" nonlinear partial differential equations, (ii) an eigenvalue of a linear operator, and (iii) a robust coherent structure with particle-like properties.

Geometry Seminar
Tuesday, January 22, 3:10-4:00pm
4088 EH
Tom Mestag (UM)
Routh reduction for Lagrangian systems with a non-Abelian symmetry group

Routh's procedure, in its original form, was concerned with eliminating from a Lagrangian problem the generalized velocities corresponding to so-called ignorable or cyclic coordinates. Such cyclic coordinates indicate that there is an Abelian symmetry group for the Lagrangian and they generate conserved quantities, the momentum. We extend this reduction procedure to Lagrangian systems whose symmetry group is not necessarily Abelian. To do so we analyse the restriction of the Euler-Lagrange field to a level set of momentum in velocity phase space. We present a new method of analysis based on the use of quasi-velocities. We will also discuss the reconstruction of solutions of the full Euler-Lagrange equations from those of the reduced equations.

Colloquium
Tuesday, January 22, 4:10-5:00pm
1360 EH
Ingrid Daubechies (Princeton)
Muliscale Analysis of Vincent Van Gogh's paintings

This talk discusses an analysis of 101 high definition gray value scans of paintings by Vincent Van Gogh and other artists, in the framework of a workshop for Art Historians and Image Processors, held in May 2007 at the Van Gogh Museum in Amsterdam. All the work was done in collaboration with Eugene Brevdo and Shannon Hughes, two graduate students in Electrical Engineering at Princeton University.

The analysis was based on wavelet transforms of the high resolution gray-level images; the distribution of wavelet coefficients in every orientation and at every scale was modeled as a mixture of two zero-mean gaussian distributions (one wide, one narrow), associated with a hidden Markov tree, with two hidden states (one for each of the distributions). This model is based upon the intuition that locations in the picture where sharp edges are present correspond to wavelet coefficients that are of type W (for wide), i.e. distributed according to the wide distribution at every scale (and thus admitting quite large values); locations where the content depicted in the picture varies smoothly correspond to wavelet coefficients of type N, i.e. distributed according to the narrow distribution (so that all values are small). Less sharp edges can correspond to a hidden state of type N for fine scale coefficients, switching to W for coarser scales. The parameters of the hidden Markov tree model were optimized; these optimal values were then combined into a feature vector that characterized the paintings.

Machine learning algorithms showed that the features that dominated the classification between paintings by Van Gogh and other artists were mostly transition probabilities from type N to type W (going from coarser to finer scales), linked to orientation-dependent scale values; these features mostly identified the scales at which detail information "emerges", as one gradually zooms in, in Van Gogh paintings more so than in non-Van Gogh paintings. These characteristic scales turn out to be different for features in different directions; the relative strength of details in each scale and orientation seems characteristic for Van Gogh's style.

To pinpoint paintings, such as copies or forgeries of true Van Goghs, that are stylistically similar to Van Goghs but are by another artist's hand, much finer scales in the wavelet transform turned out to be useful; the relative abundance of extremely fine detail led us indeed separate copies and forgeries from most of the authentic, original Van Goghs.

Working Seminar in Several Complex Variables and Complex Dynamics
Wednesday, January 23, 4:10-5:30pm
4088 EH
Jean Ruppenthal (U of Bonn)
>L^p-obstructions for the ∂-equation on a cone with isolated singularity

Let Y be a homogeneous pure dimensional variety in ℂn with an isolated singularity at the origin, and D &#x22D0Y strongly pseudoconvex, 0 D, D*=D\{0}. Moreover, let X be the projective variety defined by Y in ℂℙn-1. We will compute the obstructions to solving the ∂-equation in the Lp-sense on D* for 1≤ p ≤ ∞ in terms of some cohomology classes on X, which are well-known for example if X is an elliptic curve by the Theorem of Riemann-Roch.

Financial/Actuarial Mathematics Seminar
Thursday, January 24, 3:10-4:00pm
3088 EH
Sergey Levendorskiy (U of Texas)
Wiener-Hopf factorization as a general method for valuation of real and American options

A new general approach to optimal stopping problems in L\'evy models, regime switching L\'evy models and L\'evy models with stochastic volatility and stochastic interest rate is developed. For perpetual options, explicit solutions are found, for options with finite time horizon, time discretization is used, and explicit solutions are derived for resulting sequences of perpetual options.

The main building block is the option to abandon a monotone payoff stream. The optimal exercise boundary is found using the operator form of the Wiener-Hopf method which is standard in analysis and interpretation of the factors as {\em expected present value operators} (EPV-operators) under supremum and infimum processes. Other types of options are reduced to the option to abandon a monotone stream. For regime-switching models, an additional ingredient is an efficient iteration procedure. L\'evy models with stochastic volatility and/or stochastic interest rate are reduced to regime switching models using the discretization of the state space of additional factors. The efficiency of the method for 2 factor models with jumps and for 3-factor Heston model with stochastic interest rate is demonstrated.
This is joint work with S. Boyarchenko.

Commutative Algebra Seminar
Thursday, January 24, 3:10-4:00pm
3096 EH
Mel Hochster (UM)
Phantom homology

Note: (This talk was postponed from January 10).
This is the first of several lectures that 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.

Differential Equations
Thursday, January 24, 4:10-5:00pm
4088 EH
Mohar Guha (UM)
Front Propagation in a Noisy, Nonsmooth, Excitable Medium

We consider the impact of noise on the stability and propagation of fronts in an excitable media with a piece-wise smooth, discontinuous ignition process. In a neighborhood of the ignition threshold the system interacts strongly with noise, the front can loose monotonicity, resulting in multiple crossings of the ignition threshold. We adapt the renormalization group methods developed for coherent structure interaction, a key step being to determine pairs of function spaces for which the ignition function is Frechet differentiable, but for which the associated semi-group, S(t), is integrable at t=0.

We parameterize a neighborhood of the front solution through a dynamic front position and a co-dimension one remainder. The front evolution and the asymptotic decay of the remainder are on the same time scale, the RG approach shows that the remainder becomes asymptotically small, in terms of the noise strength and regularity, and the front propagation is driven by a competition between the ignition process and the noise.

Math Club
Thursday, January 24, 4:10-5:00pm
2nd floor Nesbitt Common Room
Loren Spice (UM)
Can you tell me the way to sum to A?

It is a familiar result from real analysis that an absolutely convergent series of real numbers may be rearranged without changing its sum, whereas conditionally convergent series may be rearranged to give any sum that we wish. What happens if we work with complex numbers rather than real numbers? We will discuss a theorem of Lévy and Steinitz that provides a neat answer to a generalization of this question.

Student Combinatorics
Thursday, January 24, 4:10-5:00pm
3866 EH
Dave Anderson (UM)
Schubert polynomials and Hessenberg varieties

Double Schubert polynomials are representatives for Schubert classes in the equivariant cohomology of a flag variety, distinguished by their pleasant combinatorial properties. Hessenberg varieties are certain subvarieties of the flag variety; it turns out that their (ordinary) cohomology classes are specializations of double Schubert polynomials. This motivates a combinatorial problem: find the expansion of a specialized double Schubert polynomial in the basis of (single) Schubert polynomials. I'll describe some results in this direction. This is joint work with Julianna Tymoczko.

Applied and Interdisciplinary Mathematics Seminar
Friday, January 25, 3:10-4:00pm
1084 EH
Jared Bronski (U of Illinois)
Krein Signatures for the Faddeev-Takhtajan Eigenvalue Problem

We consider the Faddeev-Takhtajan eigenvalue problem, for which the Sine-Gordon equation is the isospectral flow. Based on some intuition provided by some results of Klaus and Shaw on the Zakharov-Shabat eigenvalue problem, as well as some special exactly solvable potentials constructed by Miller and Buckingham, we are able to prove under certain monotonicity assumptions the point spectrum of the Faddeev-Takhtajan eigenvalue problem is simple and lies on the unit circle.
This result (as well as that of Klaus-Shaw) can be considered a generalization of the Krein stability theory for symplectic matrices. We will develop these connections throughout the talk.
This is joint work with Mat Johnson.

Student Geometry/Topology
Friday, January 25, 3:10-4:00pm
3096 EH
Aaron Magid (UM)
Simultaneous Uniformization: Connections between Hyperbolic 3-Manifolds and Teichmuller Space

There will be no bumping or self-bumping in this talk. Our goal will be to state and sketch a proof of Bers' simultaneous uniformization theorem, which parameterizes the convex cocompact hyperbolic structures one can place on the manifold S x I, where S is a closed surface of genus at least 2. We will define the Teichmuller space of a surface, a Beltrami differential, and state the measurable Riemann mapping theorem (Ahlfors-Bers), which is a key tool in the proof of simultaneous uniformization. We will also review what it means to have a hyperbolic structure on the manifold S x I, and how the hyperbolic structure is related to conformal structures on the boundary surfaces.

Combinatorics
Friday, January 25, 4:10-5:00pm
3866 EH
Patricia Hersh (Indiana)
Regular cell complexes modeling Bruhat intervals

We give a new criterion for determining whether a finite CW complex is regular. This involves both combinatorial conditions on the closure poset and also topological conditions on the codimension one cell incidences. As an application, we prove a conjecture of Fomin and Shapiro on regularity of certain stratified totally positive spaces. This completes the solution of a problem, posed by Bjorner in 1984, of constructing a naturally arising regular CW complex whose closure poset is the Bruhat order of a finite Weyl group. The proof involves showing that parametrizations of totally positive spaces due to Lusztig yield the characteristic maps.