Winter 2009
University of Michigan-Department of Mathematics
http://www.math.lsa.umich.edu/seminars/index.shtml
Ann Arbor, MI 48109-1043
April 13th – April 19th

Monday, April 13

3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- TBA --- 2866 EH
3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- Bryden Cais (McGill) *The geometry of p-adic analytic families of ordinary Galois representations* --- 4096 EH
4:10-5:00pm **Student Combinatorics** --- Kelli Talaska (UM) *Heaps of pieces* --- 3866 EH
4:10-5:00pm **Several Complex Variables and Complex Dynamics Seminar** --- TBA --- 3096 EH
4:10-6:00pm **Geometry and Physics Seminar** --- Liang Kong (Caltech) *Open-closed conformal field theories* --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- TBA --- 3096 EH

Tuesday, April 14

2:10-3:00pm "**What is … " Seminar** --- Igor Dolgachev (UM) *What is … McKay correspondence?* --- 3096 EH
3:10-4:00pm **Ziwet Lecture I** --- John Tyson (Virginia Polytechnic Institute & State University) *How do Cells Compute?* --- 1360 EH
3:10-4:00pm **Algebra Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- Victor Lozovanu (UM) *Examples of using MMP* --- 3088 EH
3:10-4:00pm **Geometry Seminar** --- TBA --- 3866 EH
3:10-4:00pm **Student Seminar in Complex Dynamical Systems** --- TBA --- 4088 EH
4:10-5:00pm **Colloquium ---** Bill Minicozzi (Johns Hopkins U) **–** *The rate of change of width under flows* **---** 1360 EH
4:10-5:00pm **Student AIM Seminar** --- TBA --- 3088 EH

Wednesday, April 15

12:00-1:00pm **Student Representation Theory Seminar (Note: non-standard time */* location)** --- Harlan Kadish (UM) *I Eat Fields Like You for Lunch: Co-ideals in Tensors of Fields* --- 2866 EH
3:10-4:00pm **Ziwet Lecture II** --- John Tyson (Virginia Polytechnic Institute & State University) *Temporal Organization of the Eukaryotic Cell Cycle* --- 340 West Hall
3:10-4:00pm **Geometric Function Theory Seminar** --- TBA --- 4096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- TBA --- 3088 EH
4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- TBA --- 3096 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Paltin Ionescu (University of Bucharest) *On the geometry of defective manifolds* --- 3088 EH

Thursday, April 16

3:10-4:00pm **Ziwet Lecture III** --- John Tyson (Virginia Polytechnic Institute & State University) *Mathematical Challenges in Systems Biology* --- 340 West Hall
3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *A Tight Closure Theory that Commutes with Localization in Equal Characteristic, Part 3* --- 3096 EH
3:10-4:00pm **Topology Seminar** --- Thomas Koberda (Harvard) *Homological representation theory of the mapping class group* --- 4088 EH

Thursday, April 16 … continued

3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Jay Vadiveloo (U of Connecticut) TBA --- 3088 EH

4:10-5:00pm **Colloquium (Special Session) ---** Benson Farb (U of Chicago) **–** *Surface bundles over surfaces* **---** 1360 EH

4:10-5:00pm **Differential Equations ---** Charlie Doering (UM) *Mathematical Models and Measures of Mixing* **---** 4088 EH

4:10-5:00pm **Math Club** --- Bryden Cais (McGill) *How to compute 45 million digits of π* --- 2nd floor Nesbitt Room

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

Friday, April 17

11:10-12:00pm **Theoretical Computer Science Seminar** --- Robert Griess (UM) *Barnes-Wall lattices and their Midwest cousins* --- CSE 3941

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Eric Shea-Brown (U of Washington) *Dynamics of Correlation and Coding in Simple Neural Circuits* --- 1084 EH

3:10-4:00pm **Student Geometry/Topology** --- TBA --- 3096 EH

4:10-5:00pm **Combinatorics** --- Maxim Kazarian (Steklov Institute) *Universal polynomials for strata in Hurwitz spaces* --- 3866 EH

EVENTS THIS WEEK

Ziwet Lectures
April 14-16, 2009
1360 East Hall & 340 West Hall
Speaker: John Tyson (Virginia Polytechnic Institute & State University)

Schedule of Talks:

How Do Cells Compute?
Tuesday, April 14 • 3:10 p.m. • Room 1360 East Hall

Temporal Organization of the Eukaryotic Cell Cycle
Wednesday, April 15 • 3:10 p.m. • Room 340 West Hall

Mathematical Challenges in Systems Biology
Thursday, April 16 • 3:10 p.m. • Room 340 West Hall

RTG Workshop on Geometric Group Theory
April 17 - April 19, 2009

UPCOMING EVENTS

Ziwet Lectures
Cedric Villani (Ecole Normale Superieure de Lyon)
October 2009

ABSTRACTS FOR THE WEEK OF APRIL 13 – APRIL 19, 2009

Group Theory/Lie Theory/Number Theory Seminar
Monday, April 13, 3:10-5:00pm
4096 EH
Bryden Cais (McGill)
The geometry of p-adic analytic families of ordinary Galois representations

In the 1980's, Hida constructed certain p-adic analytic families of ordinary Galois representations via a detailed study of Hecke algebras and group cohomology. Shortly after this, Mazur and Wiles gave a geometric interpretation of the associated families of Galois representations by realizing them in the etale cohomology groups of towers of modular curves. In accordance with the philosophy of p-adic Hodge theory, one expects that there should be a corresponding geometric construction of p-adic families of ordinary modular forms via de Rham cohomology. In this talk, we will explain such a construction; as a consequence, we obtain a new and purely geometric approach to Hida theory. Using work of Ohta, we will elucidate how our construction relates to that of Mazur-Wiles via standard comparison isomorphisms in padic Hodge theory.

Student Combinatorics
Monday, April 13, 4:10-5:00pm
3866 EH
Kelli Talaska (UM)
Heaps of pieces

We will give an introduction to Viennot's combinatorial notion of heaps of pieces. As time allows, we will explore some applications and connections to statistical physics, matrix algebra, and graph theory.

Geometry and Physics Seminar
Monday, April 13, 4:10-6:00pm
4088 EH
Liang Kong (Caltech)
Open-closed conformal field theories

In this talk, I will review recent progress in constructing conformal field theories (CFT) via vertex operator algebras (VOA). I will start with a definition of CFT in the sense of Vafa-Frenkel-Huang, then show how VOAs enter the picture. By using the representation theory of VOA, I will show that genus-0,1 open-closed CFTs can be classified by the so-called Cardy algebras. The conjecture is that a Cardy algebra gives a CFT of all genus. In the end, I will prove the open-closed (or boundary-bulk) duality in the framework of Cardy algebra.

Ziwet Lecture I
Tuesday, April 14, 3:10-4:00pm
1360 East Hall
How do Cells Compute?

The living cell is an information processing system that receives signals from its external environment and internal state and generates appropriate responses in terms of movement, differentiation, secretion, growth, division and, in extreme circumstances, suicide. These decisions are made by a complex network of signal processing proteins. Mathematical modeling is essential to understand how this network makes decisions and how it makes mistakes in mutant or diseased organisms.

Colloquium
Tuesday, April 14, 4:10-5:00pm
1360 EH
Bill Minicozzi (Johns Hopkins University)
The rate of change of width under flows

I will discuss a geometric invariant, that we call the width, of a manifold and first show how it can be realized as the sum of areas of minimal 2-spheres. When M is a homotopy 3-sphere, the width is loosely speaking the area of the smallest 2-sphere needed to ``pull over'' M. Second, we will estimate the rate of change of width under various geometric Flows, including the Ricci flow and mean curvature flow, to prove sharp estimates for extinction times. This is joint work with Toby Colding.

Student Representation Theory Seminar (Note: non-standard time / location)
Wednesday, April 15, 12:00-1:00pm
2866 EH
Harlan Kadish (UM)
I Eat Fields Like You for Lunch: Co-ideals in Tensors of Fields

Pack a lunch with some basic commutative algebra and explore tensors of fields! A closed equivalence relation on an affine variety X gives an ideal I of k[X x X], where the reflexivity, symmetry, and transitivity of the relation correspond to similar properties of I. Take these properties as axioms for an "equivalence relation ideal," and consider a field extension M/K. Then there exists a bijection between, on the one hand, the equivalence relation ideals of M tensored over K, and on the other hand, subfields of M containing K. Moreover, such ideals have nice generators.

Ziwet Lecture II
Wednesday, April 15, 3:10-4:00pm
340 West Hall
Temporal Organization of the Eukaryotic Cell Cycle

The cell cycle is the sequence of events by which a growing cell replicates all its components and divides them more-or-less evenly between two daughter cells. This sequence of events is controlled by a complex network of interacting proteins. To understand this control system works requires two sorts of mathematics: detailed computer simulations of the intricacies of the network in real cells, and simple ODE models that reveal its fundamental regulatory principles in terms of robust bifurcations of vector fields

Algebraic Geometry Seminar
Wednesday, April 15, 4:10-6:00pm
3088 EH
Paltin Ionescu (University of Bucharest)
On the geometry of defective manifolds

The first part of the talk, intended for a general audience, will introduce a classical theme in projective geometry: isomorphic projections and the related study of the secant variety. Zak's work on Hartshorne's Conjecture and the classification of Severi varieties will be part of the historical account. Next, we will introduce and motivate the simplest class of secant defective manifolds. The defining property is the presence of a quadric of maximal possible dimension, contained in the given variety and joining two of its general points. These varieties turn out to be Fano manifolds of high index and may be thoroughly studied by techniques coming from Mori Theory. Conjecturally, they should be completely described starting from the known list of homogeneous defective manifolds. Finally, we will try to suggest how the classification of dual defective manifolds would follow from the above considerations.
This is based on joint work with F. Russo.

Ziwet Lecture III
Thursday, April 16, 3:10-4:00pm
340 West Hall
Mathematical Challenges in Systems Biology

Molecular systems biology (MSB) is the flip-side of molecular cell biology (MCB). Whereas MCB'ists break down cells into their component genes and proteins, MSB'ists try to put the pieces back together again, into an integrated view of cell physiology at many scales of space and time. MSB is not only an exciting and important new field of life science, but also it is inescapably mathematical and computational. In order that UM mathematicians not miss out on all the fun, let's have a brain-storming session on what the hard problems are and where we can have an immediate and lasting impact.

Topology Seminar
Thursday, April 16, 3:10-4:00pm
4088 EH
Thomas Koberda (Harvard)
Homological representation theory of the mapping class group

I seek to understand the algebraic structure of the mapping class group and the dynamical behavior of individual classes by studying the representation theory of the mapping class group on the homology of certain finite covers. I will explain how we can construct a faithful infinite-dimensional representation of the mapping class group and recover the Nielsen-Thurston classification of each class. I will also indicate connections with the representation theory of nilpotent Lie groups.

Colloquium (Special Session)
Thursday, April 16, 4:10-5:00pm
1360 EH
Benson Farb (U of Chicago)
Surface bundles over surfaces

The goal of this talk will be to survey the theory of surface bundles over surfaces. This topic connects to areas from algebraic geometry to combinatorial group theory to Teichmuller theory. This largely unexplored subject has many open questions, some of which will be presented in this talk.

Differential Equations
Thursday, April 16, 4:10-5:00pm
4088 EH
Charlie Doering (UM)
Mathematical Models and Measures of Mixing

Mixing by stirring can be measured in a variety of ways including tracer particle dispersion, in terms of the scalar flux-gradient relationship, or via suppression of scalar density variations sustained by inhomogeneous sources and sinks. The mixing efficacy of a given flow is often expressed in terms of enhanced diffusion and quantified as an effective diffusivity.

In this work we compare and contrast these various notions of effective diffusivity. Through thorough examination of a simple shear flow stirring a passive scalar sustained by a steady, single-scale source-sink distribution, we explore apparent inconsistencies and propose a conceptual approach that captures compatible features of the different models and measures of mixing. This is joint work with Katarina Bodova and Zhi Lin.

Math Club
Thursday, April 16, 4:10-5:00pm
2nd Floor Nesbitt Room
Bryden Cais (McGill)
How to compute 45 million digits of π

By definition, π is the ratio of the circumference of a circle to its diameter. However, if you try to compute *π* as a decimal expansion from this definition, you won't get very far: even if you had a circle with circumference the size of the entire universe and could measure to within the accuracy of the diameter of a proton, you'd only be able to compute about 49 digits of π correctly. You might try and use your calculus skills and clever formulae with trig functions to do better (as Newton and Leibnitz did) but even if you toiled 15 years in the labor (as Shanks did) you'd be unable to compute more than 707 digits, and you'd probably make a mistake (as Shanks did, at decimal place 527).

In this talk, I'll describe (and prove the validity of) a simple iterative algorithm for computing *π* efficiently and quickly: after a mere 24 iterations (and but a few hundred arithmetic operations), the algorithm produces over 45 million correct digits of π. This algorithm is based on a powerful connection between elliptic integrals and the arithmetic-geometric mean. I'll only use (clever) calculus in this talk; in particular, no prior knowledge of elliptic integrals will be assumed.

Theoretical Computer Science Seminar
Friday, April 17, 11:10-12:00p
CSE 3941
Robert Griess (UM)
Barnes-Wall lattices and their Midwest cousins

The series of Barnes-Wall lattices, of ranks 2^d, are useful in providing context and tools for combinatorial situations, such as spherical codes and constructions of new families of lattices with moderately high minimum norms. The role of finite group theory here is significant. We shall discuss our recent work along these lines.

Applied and Interdisciplinary Mathematics Seminar
Friday, April 17, 3:10-4:00pm
1084 EH
Eric Shea-Brown (University of Washington)
Dynamics of Correlation and Coding in Simple Neural Circuits

Correlations among neural spike times are ubiquitous, and questions of how these correlations develop, and of the impact they have on the neural code, are central in neuroscience. Their analysis also poses rich applied mathematics problems. We address two of the most basic ones here.

First, we ask: How do correlations among different neurons depend on the cells' operating range -- their rate and regularity of spiking? We use both linear response calculations and in vitro experiments to show that correlations between pairs of neurons vary sharply with their firing rates, almost universally. We illustrate the consequences via Fisher information, which quantifies the accuracy of encoding.

Next, we ask: How do correlations among different trials depend on architecture of neural circuits? (Here, the same stimulus is received by the circuit on each 'trial.') We take a first step toward the answer by identifying a surprising role for some, but not all, feedback connections in creating unreliable (and hence decorrelated) responses, a phenomenon which we quantify via Lyapunov exponents.

This is joint work with Jaime de la Rocha, Brent Doiron, Kreso Josic, Kevin Lin, Alex Reyes, and Lai-Sang Young.

Combinatorics
Friday, April 17, 4:10-5:00pm
3866 EH
Maxim Kazarian (Steklov Institute)
Universal polynomials for strata in Hurwitz spaces

A Hurwitz space is a moduli spaces of meromorphic functions on complex curves. It is stratified according to the degeneration types of the critical values of the function. We compute explicitly the cohomology classes dual to the strata. These classes are represented in the form of universal expressions that are independent of the particular Hurwitz space, but completely determined by the local singularity type of critical values. The results are obtained by extending the theory of Thom polynomials of singularities and its multisingularity version to the case of maps with nonisolated singularities. The obtained expression contain all enumerative data related to the strata. In this way, we derive new closed expressions for a number of particular series of Hurwitz numbers.