

Fall 2007
University of Michigan-Department of Mathematics
<http://www.math.lsa.umich.edu/seminars/index.shtml>
Ann Arbor, MI 48109-1043

December 10th – December 16th

Monday, December 10

- 3:10-4:00pm **Student Analysis Seminar** --- *Open Problem Session* --- 3866 EH
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- TBA --- 2866 EH
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Carl Miller (UM)
Equicharacteristic Galois representations of local function fields --- 4096 EH
4:10-5:00pm **Several Complex Variables Seminar** --- Araceli Bonifant (U of Rhode Island)
Schwarzian derivatives and cylinder maps --- 3096 EH
4:10-6:00pm **Geometry & Physics** --- David Ben-Zvi (Texas) *Langlands Duality and Topological Field Theory* --- 4088 EH
5:15-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

Tuesday, December 11

- 2:10-3:00pm **"What is ... " Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Cagatay Kutuhan (UM) *Symplectic Forms on Product 4-Manifolds* --- 4088 EH
3:10-4:00pm **Algebra Seminar** --- Ualbai Umirbaev (Wayne State/Eurasian National U)
Automorphisms of polynomial and free algebras --- 3088 EH
3:10-4:00pm **Student Representation Theory/Lie Theory Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Colloquium** --- Not meeting this week --- 1360 EH

Wednesday, December 12

- 3:10-4:00pm **Geometric Function Theory Seminar** --- Not meeting this week --- 4096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- TBA --- 3866 EH
3:10-4:00pm **Student AIM Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Working Group in Integrable Systems and Asymptotics** --- TBA --- 4088 EH
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- TBA --- 4088 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- Amanda Knecht (UM) *Weak Approximation and Strong Rational Connectivity* --- 3088 EH

Thursday, December 13

- 2:10-3:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3866 EH
2:10-3:00pm **Study Seminar (Pt. 1)** --- TBA --- 3096 EH
3:10-4:00pm **Study Seminar (Pt. 2)** --- TBA --- 4088 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- TBA --- 3866 EH
3:10-4:00pm **Commutative Algebra Seminar** --- TBA --- 3096 EH
3:10-4:00pm **Topology Seminar** --- TBA --- 4096 EH
4:10-5:00pm **Differential Equations** --- TBA --- 4088 EH
4:10-5:00pm **Math Club** --- TBA --- 2nd floor Nesbitt Common Room
4:10-5:00pm **Student Combinatorics** --- Not meeting this week --- 3866 EH

Friday, December 14

- 10:50-12:00pm **EECS Theory Seminar** --- TBA --- CSE 3941
3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar (Note non-standard room)** --
- Weihua Geng (MSU) *Treatment of charge singularities and calculation of solvation forces in implicit solvent models* --- 4096 EH
3:10-4:00pm **Student Geometry/Topology** --- TBA --- 3096 EH
4:10-5:00pm **Combinatorics** --- TBA --- 3866 EH

UPCOMING EVENTS

Rainich Lecture
Jan. 15-17, 2008
Speaker: Gang Tian

Ziwet Lecture
Feb. 5, 2008
Speaker: Curtis McMullen

ABSTRACTS FOR THE WEEK OF DEC. 10 – DEC. 16, 2007

Student Analysis Seminar
Monday, December 10, 3:10-4:00pm
3866 EH
Open Problem Session

This will be a discussion forum. The plan is to state research problems related to analysis and geometry, and then share ideas related to problems (or possibly, solutions).

Problems are welcome. If you have one in mind and would like to share, then bring it along to the session, or email it to us at student-analysis@umich.edu.

Number Theory and Representation Theory Seminar
Monday, December 10, 3:10-5:00pm
4096 EH
Carl Miller (UM)
Equicharacteristic Galois representations of local function fields

Let k be a finite field and let G be the absolute Galois group of $k((t))$. I will discuss an invariant which measures the complexity of G -representations over F_p ($p = \text{char}(k)$). This invariant has some applications to cohomology in positive characteristic.

Several Complex Variables Seminar
Monday, December 10, 4:10-5:00pm
3096 EH
Araceli Bonifant (U of Rhode Island)
Schwarzian derivatives and cylinder maps

Siu and Demailly's strategy for Kobayashi's hyperbolicity conjecture involves the construction of global holomorphic jet differentials which are (locally) invariant under reparametrization. For jets of orders 2, 3 and 4 in dimension 2; for jets of order 2 and 3 in dimension 3, the so-called bracket procedure generates all the invariants (3, 5, 9; 6, 16 respectively). For jets of order 5 in dimension 2, the 36 bracket invariants share 210 syzygies; for jets of order 6 in dimension 2, there would exist 210 bracket invariants sharing 14 950 syzygies. However, already for jets of order 5, we show that bracketing is not enough, and maybe, infinitely many invariants exist, as in Nagata's counterexample to Hilbert's 14th problem-conjecture. Strikingly, 5 is also the minimal expected degree for Kobayashi-hyperbolicity of surfaces of \mathbb{P}^3 .

Geometry & Physics
Monday, December 10, 4:10-6:00pm
4088 EH
David Ben-Zvi (Texas)
Langlands Duality and Topological Field Theory

I will describe a new framework for the representation theory of real and complex semisimple Lie groups, developed in joint work with David Nadler. We show how different aspects of representation theory (including the theory of intertwining operators, Lusztig's character sheaves and character varieties for surface groups) fit into the structure of a topological field theory (the character theory) which we associate to a Lie group. The main result is an equivalence between the character theories for Langlands dual groups, which may be considered as a three-dimensional aspect of the electric-magnetic duality of four-dimensional gauge theories. Time permitting, I will discuss how our approach gives a strong form of the local Langlands program over the reals.

Geometry Seminar
Tuesday, December 11, 3:10-4:00pm
4088 EH
Cagatay Kutuhan (UM)
Symplectic Forms on Product 4-Manifolds

Let M be a closed, oriented 3-manifold. It is known that if M fibers over S^1 , then $S^1 \times M$ admits a symplectic form. A natural yet a more subtle question has been posed by Taubes: Is the converse true? It turns out that there might be a deep geometric reason behind a possible correspondence between 3-manifolds which fiber over S^1 and product 4-manifolds which admit symplectic structures. I will talk about the geometric significance of this problem and lay out the tools being used in an attempt to provide an affirmative answer to this question. This is a report on ongoing work on my thesis.

Algebra Seminar
Tuesday, December 11, 3:10-4:00pm
3088 EH
Ualbai Umirbaev (Wayne State/Eurasian National U)
Automorphisms of polynomial and free algebras

It is well-known that the automorphisms of polynomial algebras (Jung, 1942; van der Kulk, 1953) and free associative algebras (Makar-Limanov, 1970; Czerniakiewicz, 1971-1972) in two variables are tame. This talk concerns the last results in this area:

1. The well-known Nagata automorphism of the polynomial algebra in three variables is wild, that is, it can not be decomposed into a product of elementary automorphisms (Shestakov, Umirbaev);
2. The well-known Anick automorphism of the free associative algebra in three variables is wild (Umirbaev).

I will give a survey of results of the last years related with these results.

Applied and Interdisciplinary Mathematics Seminar (Note non-standard room)
Friday, December 14, 3:10-4:00pm
4096 EH
Weihua Geng (MSU)
Treatment of charge singularities and calculation of solvation forces in implicit solvent models

A novel method is presented for solving the Poisson-Boltzmann (PB) equation based on a rigorous treatment of geometric singularities of the dielectric interface and a Green's function formulation of charge singularities. Geometric singularities, such as cusps and self-intersecting surfaces, in the dielectric interfaces are bottleneck in developing highly accurate PB solvers. Based on an advanced mathematical technique, the matched interface and boundary (MIB) method, we have recently developed an accurate PB solver, MIBPB-II by rigorously enforcing the flux continuity conditions at the dielectric interface where geometric singularities may occur. However, when mesh size approaches half of the van der Waals radius, MIBPB-II cannot maintain its accuracy because the grid points that carry the interface information overlap with points carrying distributed charges. In the present Green's function formalism, charge singularities are transformed into interface jump conditions, which are treated on an equal footing as the geometric singularities in our MIB framework. The resulting method, denoted as MIBPB-III, is able to provide highly accurate electrostatic potentials at a mesh as coarse as 1.2 angstrom for proteins. The MIBPB-III has been extensively validated by using analytically solvable problems and molecular surfaces of polyatomic systems, and proteins.

An important and direct application of the solution of PBE is to calculate the solvation forces, which are the basis for molecular dynamics simulation. We provide MIB based solvation forces calculation schemes, taking advantage of the accurate potentials output from MIBPB solver and again the incorporation of interface jump conditions. As one of the important components of the solvation forces, the accuracy of dielectric boundary forces, which were traditionally calculated by using smoothed dielectric interface, is improved by resorting to a level set based 1st order surface integral. Several examples and comparisons are presented to validate the schemes.