

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

December 1st – December 7th

Monday, December 1

- 12:10-1:00pm **Math/Bio Seminar** --- Richard Yamada (UM) TBA --- 4096 EH
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- TBA --- 2866 EH
3:10-5:00pm **Group Theory/Lie Theory/Number Theory Seminar** --- Roman Holowinsky (Toronto)
The Rudnick-Sarnak Conjectures --- 4096 EH
4:10-5:00pm **Student Combinatorics** --- Ajinkya More (UM) *Groebner Bases and Integer
Programming* --- 3866 EH
5:15-6:00pm **Teaching Mathematics** --- Dilip Das (UM-Provost's Office) *Institutional Barriers to Math
Achievement* --- 3096 EH

Tuesday, December 2

- 2:10-3:00pm **"What is ... " Seminar** --- Not meeting this week --- 3096 EH
3:10-4:00pm **Several Complex Variables and Complex Dynamics Seminar (Non-standard
day/time/location)** --- Erlend Fornaess Wold (U of Oslo) *Polynomial Convexity and
Totally real manifolds* --- 4088 EH
3:10-4:00pm **Algebra Seminar** --- Kurt Luoto (U of Washington) *Refinements of the Littlewood-
Richardson Rule* --- 3096 EH
3:10-4:00pm **Geometry Seminar** --- Mikio Furuta (RIMS/MIT) *Polarization and Localization* --- 4096
EH
3:10-4:00pm **Student Algebraic Geometry Seminar** --- TBA --- 3088 EH
4:10-5:00pm **Colloquium** --- Boris Khesin (U of Toronto) *Holomorphic linking number and gauge
theory* --- 1360 EH
4:10-5:00pm **Student AIM Seminar** --- TBA --- 3088 EH
5:10-6:00pm **Social Hour** --- Upper Atrium

Wednesday, December 3

- 3:10-4:00pm **Geometric Function Theory Seminar** --- Jonathan Novak (Queen's University) *Random
contraction matrices, vicious walkers, and Toeplitz determinants* --- 4096 EH
3:10-4:00pm **Student Representation Theory Seminar** --- Farkhod Eshmatov (EH) TBA --- 3096 EH
3:10-4:00pm **Student Arithmetic Seminar** --- Chris Hall (UM) *Twin-prime pairs of polynomials* ---
3866 EH
4:10-5:00pm **RTG Working Seminar in Several Complex Variables and Complex Dynamics** --- Not
meeting this week --- 3096 EH
4:10-6:00pm **Algebraic Geometry Seminar** --- TBA --- 3088 EH

Thursday, December 4

- 3:10-4:00pm **Commutative Algebra Seminar** --- Tigran Ananyan (UM) *Some Results on Finite
Phantom Projective Dimension* --- 3096 EH
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Not meeting this week --- 3088 EH
3:10-4:00pm **Topology Seminar** --- Soren Galatius (Stanford) TBA --- 4096 EH
4:10-5:00pm **Differential Equations** --- Claude Bardos (Univ. Paris 6) *Multiconfiguration Time
Dependent Hartree Fock Method* --- 4088 EH
4:10-5:00pm **Math Club** --- Divakar Viswanath (UM) *The Leibniz Series and Nonlinear Sequence
Transformations* --- 2nd floor Nesbitt Common Room
4:10-5:00pm **Reading Group in Probabilistic Methods in Geometric Functional Analysis and
Combinatorics** --- 3096 EH
4:10-6:00pm **RTG Study Seminar** --- Juan Souto (UM) *Dynamics of the geodesic and horocyclic flows
of hyperbolic surfaces* --- 3866 EH

4:10-6:00pm **Geometry and Physics Seminar** --- Patrick Clarke (U Penn) *Landau-Ginzburg models, homological mirror symmetry, and T-duality* --- 4096 EH

Friday, December 5

11:10-12:00pm **Theoretical Computer Science Seminar** --- Not meeting this week --- CSE 3941

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Eitan Geva (UM) *The Computational Challenge of Simulating Many-body Quantum Anharmonic Dynamics* --- 1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Various Speakers (UM) *Areas in Topology/Geometry at Michigan* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Melvyn Nathanson (Lehman/CUNY) *Quasi-isometries, phase transitions, and other problems in additive number theory* --- 3866 EH

ABSTRACTS FOR THE WEEK OF DEC. 1 – DEC. 7, 2008

Group Theory/Lie Theory/Number Theory Seminar

Monday, December 1, 3:10-5:00pm

4096 EH

Roman Holowinsky (Toronto)

The Rudnick-Sarnak Conjectures

This talk will discuss the quantum unique ergodicity (QUE) conjecture of Rudnick and Sarnak as well as various analogous equidistribution statements. The QUE problem comes from an area of physics known as quantum chaos and provides connections between classical dynamical systems and their quantum models. Certain dynamical systems associated with negatively curved arithmetic surfaces have strong connections with number theory. We'll describe this number theoretic setting and provide a sketch as to how one may prove QUE in these cases. Part of the talk will cover recent joint work with K. Soundararajan.

Student Combinatorics

Monday, December 1, 4:10-5:00pm

3866 EH

Ajinkya More (UM)

Groebner Bases and Integer Programming

The theory of Grobner basis for modules over polynomial rings finds applications in Commutative Algebra, Algebraic Geometry and Combinatorics as well as in applied mathematical areas such as Integer Programming, Coding theory and Systems theory. I shall give an elementary introduction of the theory of Grobner basis and discuss its application to Integer programming problems. Algebra at the level of 593 will be assumed.

Teaching Mathematics
Monday, December 1, 5:15-6:00pm
3096 EH
Dilip Das (UM-Provost's Office)
Institutional Barriers to Math Achievement

President Coleman was a prominent member of the Lt. Governor Cherry Commission on Higher Education and Economic Growth in 2004. The Governor appointed the Commission in response to the unprecedented and rapid conversion from a manufacturing economy in Michigan to one necessarily grounded in technological and informational innovation. One of the many recommendations of the Commission was to double the number of postsecondary degrees in the state. One pathway for this increase is transfer from two-year to four year universities. This discussion will focus on the multiple barriers to student success in both two year and four year institutions.

Several Complex Variables and Complex Dynamics Seminar (Non-standard day/time/location)
Tuesday, December 2, 3:10-4:00pm
4088 EH
Erlend Fornaess Wold (U of Oslo)
Polynomial Convexity and Totally real manifolds

To generalize the Andersen-Lempert theory of automorphisms of C^n to the non-compact setting, it will be important to understand polynomial convexity in this case. We will discuss generic properties of totally real manifolds in C^n .

Algebra Seminar
Tuesday, December 2, 3:10-4:00pm
3096 EH
Kurt Luoto (U of Washington)
Refinements of the Littlewood-Richardson Rule

The most important basis for the algebra of symmetric functions is the basis of Schur functions. Its structure constants, the coefficients in the expansion of products of Schur functions, are the well-known Littlewood-Richardson coefficients. These are known to be nonnegative integers, and they have a combinatorial interpretation known as the Littlewood-Richardson Rule. Recently, Haglund, Mason, and van Willigenburg discovered a new basis for the quasisymmetric function algebra. These "quasisymmetric Schur functions" decompose the symmetric Schur functions, and are in turn sums of Demazure atoms. We present three analogs of the Littlewood-Richardson Rule for products of symmetric Schur functions with Demazure atoms, Demazure characters, and quasisymmetric Schur functions respectively.

Geometry Seminar
Tuesday, December 2, 3:10-4:00pm
4096 EH
Mikio Furuta (RIMS/MIT)
Polarization and Localization

In the passage from classical mechanics to quantum mechanics, one expects that the quantum states of a quantum system correspond to the Bohr—Sommerfeld fibers which are defined using a real polarization. A mathematical formulation of this expectation leads to a comparison problem for geometric quantizations obtained using real polarization and Kahler polarization. I will explain an approach to this comparison via introducing a localization technique for the Riemann—Roch number of a spin^c manifold with a torus fibration. (Joint work with Takahiko Yoshida and Hajime Fujita)

Student Arithmetic Seminar
Wednesday, December 3, 3:10-4:00pm
3866 EH
Chris Hall (UM)
Twin-prime pairs of polynomials

The well-known twin-prime problem asks whether there are infinitely many rational primes p so that $p+2$ is also prime. While the empirical evidence supports an affirmative answer, the problem remains open. One can pose a similar question for polynomials over a finite field: are there infinitely many pairs $f, f+1$ in $F_q[t]$ such that $f, f+1$ are prime? We will show that the answer is affirmative if there is an odd prime ℓ dividing $q-1$, and we will explain how to prove analogous results for n -tuples of polynomials when $n > 2$. If time permits, we will also show how one can obtain results when $q-1$ is a power of 2.

Commutative Algebra Seminar
Thursday, December 4, 3:10-4:00pm
3096 EH
Tigran Ananyan (UM)
Some Results on Finite Phantom Projective Dimension

I will sketch counterexamples to two conjectures posed by Aberbach-Hochster about localizing and taking direct summands of a module of finite phantom projective dimension. These will be among main results of my PhD thesis.

Differential Equations
Thursday, December 4, 4:10-5:00pm
4088 EH
Claude Bardos (Univ. Paris 6)
Multiconfiguration Time Dependent Hartree Fock Method

This talk is devoted to the so called MCTDHF method for the approximation of solutions of N particles Schrödinger equation with binary interaction. With the Pauli exclusion principle a natural Galerkin basis for approximation would be a time dependent linear finite sum of Slater determinants constructed from a one particles hilbertian basis.

In the MCTDHF one considers also that such basis is time dependent. Therefore the solution is represented as living on the basis of a fiber bundle. Hence several representation for solutions among them one based on a variational principle and another one called working equation more adapted to theoretical and numerical analysis.

The introduction of the variational equation leads to the conservation of energy and to some a posteriori estimates.

Using both representation one obtain local and global existence and stability results for the solution. Eventually the invertibility of a global "density" matrix plays a crucial role in the analysis and in the computation. Regularising this matrix destroy the conservation of energy and therefore requires for global stability an analysis in less regular spaces. Such analysis is provided by standard use of Strichartz estimates.

Math Club
Thursday, December 4, 4:10-5:00pm
2nd floor Nesbitt Common Room
Divakar Viswanath (UM)
The Leibniz Series and Nonlinear Sequence Transformations

The Leibniz series $\pi/4 = 1 - 1/3 + 1/5 - 1/7 + 1/9 - \dots$ converges very slowly. An estimate of π using terms until and including $1/9$ will have an error of about 0.4. However, the sequence $1, 1 - 1/3, 1 - 1/3 + 1/5, \dots$ has much more information in it than might appear at first sight. Using just the first five terms of that sequence and a nonlinear sequence transformation, one can deduce the value of π to 9 digits of accuracy, as we will explain.

Geometry and Physics Seminar
Thursday, December 4, 4:10-6:00pm
4096 EH
Patrick Clarke (U Penn)
Landau-Ginzburg models, homological mirror symmetry, and T-duality

Duality for toric Landau-Ginzburg models unifies the many mirror constructions found in the literature for complete intersections in toric varieties. Furthermore, their toric structure suggests that homological mirror symmetry for dual pairs can be attacked directly using T-duality. I will discuss this approach, and a generalization of T-duality that has arisen while attempting to implement it. Time permitting, I will also talk about a recent project with Josh Guffin in which we give a mirror construction for $(0,2)$ toric Landau-Ginzburg models near the $(2,2)$ locus.

Applied and Interdisciplinary Mathematics Seminar
Friday, December 5, 3:10-4:00pm
1084 EH

Eitan Geva (UM)

The Computational Challenge of Simulating Many-body Quantum Anharmonic Dynamics

Modern computational chemistry strives to provide an atomistically detailed dynamical description of fundamental chemical processes. The strategy for reaching this goal generally follows a two-step program. In the first step, electronic structure calculations are used to obtain the force fields that the nuclei are subject to. In the second step, molecular dynamics simulations are used to describe the motion of the nuclei. The first step is always based on quantum mechanics, in light of the pronounced quantum nature of the electrons. However, the second step is most often based on classical mechanics. Indeed, classical molecular dynamics simulations are routinely used nowadays for describing the dynamics of complex chemical systems that involve tens of thousands of atoms. However, there are many important situations where classical mechanics cannot be used for describing the dynamics. The challenge involved in simulating the quantum molecular dynamics of such systems has to do with the fact that the computational effort involved in solving the time-dependent Schrödinger equation is exponentially larger than that involved in solving Newton's equations. As a result, a numerically exact solution of the Schrödinger equation is not feasible for a system that consists of more than a few atoms. In this talk, I will describe attempts aimed at developing rigorous and accurate mixed quantum-classical, quasi-classical and semiclassical methods that would make it possible to simulate equilibrium and nonequilibrium quantum dynamics of systems that consist of hundreds of atoms and molecules. Emphasis will be put on applications to experimentally-relevant disordered complex condensed phase systems such as molecular liquids, which serve as hosts for many important chemical processes.

Student Geometry/Topology
Friday, December 5, 3:10-4:00pm
3096 EH

Various Speakers (UM)
Areas in Topology/Geometry at Michigan

Several older graduate students will give short informal talks about their research and their advisors' research. First and second year students thinking about studying topology and/or geometry are especially encouraged to attend.

Combinatorics
Friday, December 5, 4:10-5:00pm
3866 EH

Melvyn Nathanson (Lehman/CUNY)
Quasi-isometries, phase transitions, and other problems in additive number theory

This is a survey of recent work in combinatorial and additive number theory suggested by a problem of Richard Schwartz in metric geometry and geometric group theory. The central object is a group with an infinite set of generators, and the induced metric. Examples are the additive group of integers, with generators being addition (or subtraction) of $\{a^j: j=0, 1, 2, \dots\}$, for a given integer $a > 1$. One can ask when two such metrics are bi-Lipschitz equivalent. Some results and many open problems will be discussed.