UNIVERSITY OF MICHIGAN
Department of Mathematics

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Thursday, January 10, 2013 | |
|---|---|
| 2:30pm-7:00pm | **Financial/Actuarial Mathematics** -- Ross Kravitz (UM) *Thesis Defense: Problems in Optimal Stopping and Control* -- 1360 East Hall |
| 3:00pm-4:00pm | **Commutative Algebra** -- Greg Muller (Louisiana State University) *Locally acyclic cluster algebras* -- 3096 East Hall |
| 4:00pm-5:00pm | **Differential Equations** -- Benjamin Dodson (Berkeley) *Mass critical nonlinear Schrodinger equation* -- 4088 East Hall |

| Friday, January 11, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Bogdan Vioreanu (University of Michigan) *Spectra of multiplication operators as a numerical tool* -- 1084 East Hall |

| Monday, January 14, 2013 | |
|---|---|
| 12:00pm-1:00pm | **Mathematical Biology** -- Silas Alben (University of Michigan) *Mechanical models of fish and krill swimming* -- 335 West Hall |
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Florian Sprung (Brown University) *Pairs of p-adic analogues of the conjectures of Birch and Swinnerton-Dyer* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Zhixian Zhu (UM) *An Invitation to Fujita's Conjectures 1* -- 4088 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Steffen Marcus (Utah) *Computations and comparisons for double ramification classes on the moduli space of curves* -- 4088 East Hall |
| 4:00pm-5:00pm | **Several Complex Variables** -- Tuyen Truong (Syracuse) *On automorphisms of blowups of projective manifolds* -- 3096 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- () *Planning and Cookies!* -- 3088 East Hall |

| Tuesday, January 15, 2013 | |
|---|---|
| 2:10pm-3:00pm | **What is... ?** -- Peter Miller (Univ of Michigan) *What is the inverse-scattering transform?* -- 3866 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- Horng-Tzer Â Yau (Harvard University) *Ziwet Lectures: Universality of random matrices and log-gases* -- 1360 East Hall |

| Wednesday, January 16, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- () *Organizational meeting* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- All (UM) *Organizational meeting* -- 2866 East Hall |
| 3:00pm-4:00pm | **Student AIM Seminar** -- () *Planning Meeting* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Holly Krieger (UIC) *TBA* -- 3088 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Horng-Tzer Yau (Harvard University) *Dyson's Brownian and De Georgi-Nash-Moser theory of parabolic regularity. (Ziwet Lecture II)* -- 1360 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Thursday, January 17, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Topology** -- Grigori Avramidi (University of Chicago) *Symmetries of aspherical manifolds* -- 3866 East Hall |
| 3:00pm-4:00pm | **SPECIAL EVENT** -- Paul Gauthier (Univ. of Montreal) *Zero-free polynomial approximation and universality of the Riemann zeta-function* -- 3088 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Matthew Satriano (Univ. of Michigan) *The Four Squares Theorem* -- Nesbitt Room |
| 4:00pm-5:00pm | **Differential Equations** -- Philip Isett (Princeton Univ.) *Holder Continuous Euler Flows with Compact Support in Time* -- 4088 East Hall |
| 4:00pm-7:00pm | **Logic** -- Daniel Hathaway (U. Mich.) *Domination of Continuous and Borel functions* -- 2866 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- () *Organizational Meeting* -- 3096 East Hall |

| Friday, January 18, 2013 | |
|---|---|
| 10:30am-11:30am | **Theoretical Computer Science** -- Seth Pettie (U-M) *The Locality of Distributed Symmetry Breaking* -- 3941 BBB/CSE |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Jean M.-S. Lubuma (University of Pretoria, South Africa) *On nonstandard finite-difference schemes in biosciences* -- 1084 East Hall |
| 3:00pm-4:00pm | **Mathematical Biology** -- Jean M.-S. Lubuma (Dept. of Mathematics and Applied Mathematics, University of Pretoria, South Africa) *On nonstandard finite-difference schemes in biosciences* -- 1084 East Hall |
| 3:00pm-4:00pm | **Geometry** -- Christopher Mooney (Bradley University) *Old School Topology and Invariants of CAT(0) Group Boundaries* -- 3096 East Hall |
| 3:00pm-5:00pm | **Kottwitz Seminar** -- Ryan Reich (UM) *Multiplicity one for automorphic representations of GL_n* -- 3088 East Hall |
| 4:10pm-5:00pm | **Combinatorics** -- Tomoo Matsumura (KAIST) *(Factorial) Schur functions and weighted Grassmannians* -- 3866 East Hall |

| Monday, January 21, 2013 | |
|---|---|
| 4:00pm-6:00pm | **Geometry & Physics** -- Tudor Dimofte (IAS) *3-Manifolds and 3d Gauge Theories* -- 4088 East Hall |

| Tuesday, January 22, 2013 | |
|---|---|
| 4:10pm-5:00pm | **Colloquium Series** -- Richard Tapia (Rice University) *The Isoperimetric Problem Revisited: Extracting a Short Proof of Sufficiency from Euler's 1744 Proof of Necessity* -- 1360 East Hall |
| 5:15pm-6:30pm | **Teaching Mathematics** -- Nina White (Univ Michigan, Math Dept and School of Education) *The math content sequence for pre-service elementary teachers: students, goals, and methods* -- 3096 East Hall |

| Wednesday, January 23, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Zach Scherr (UM) *Linear Forms in Logarithms* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Luis Nunez-Betancourt (UM) *An overview of tight closure* -- 2866 East Hall |
| 3:10pm-4:00pm | **Colloquium Series** -- Sarah Koch (Harvard University) *An algebraic fingerprint for postcritically finite rational maps* -- B844 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Bobbie Wu (University of Michigan) *Fractal Image Compression* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Tyler Foster (Yale) *Configuration operads via quiver Grassmannians* -- 3088 |

East Hall

| Thursday, January 24, 2013 | |
|---|---|
| 4:00pm-5:00pm | **Math Club** -- Hester Graves (IDA) *Drawing and the Projective Plane* -- Nesbitt Room |
| 4:00pm-5:00pm | **Differential Equations** -- Joe Conlon (Umich) *On Global Stability for Lifschitz-Slyozov-Wagner like equations* -- 4088 East Hall |
| 4:00pm-5:30pm | **Logic** -- Daniel Hathaway (Univ. of Michigan) *Domination of Borel functions* -- 2866 East Hall |
| 4:10pm-6:00pm | **Analysis/Probability Learning Seminar** -- Mark Rudelson (University of Michigan) *A simple proof of Paouris' inequality* -- 4096 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- Matt Jacobs (University of Michigan) *The Prime Number Theorem* -- 3096 East Hall |

| Friday, January 25, 2013 | |
|---|---|
| 10:00am-11:00am | **Theoretical Computer Science** -- Travis Martin (U-M) *Characterizing Strategic Cascades on Networks* -- 411 West Hall |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Charlie Doering (University of Michigan) *Features of fast living: on the weak selection for longevity in degenerate birth-death processes* -- 1084 East Hall |

| Monday, January 28, 2013 | |
|---|---|
| 12:00pm-1:00pm | **Mathematical Biology** -- Adam Stinchcombe (Courant Institute of Mathematical Sciences, New York University) *General gene-state switching models for stochastic gene expression* -- 335 West Hall |
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Baiying Liu (University of Minnesota) *Fourier Coefficients of Automorphic Forms and Arthur Classification* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Linquan Ma (UM) *Fujita's conjecture in characteristic p* -- 4088 East Hall |
| 3:00pm-4:00pm | **Student Geometry/Topology** -- David Renardy (UM) *Computing the Khovanov Homology* -- 3096 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Huazhong Ke (Tsinghua Univ/Michigan) *Quantum McKay correspondence via gauged linear sigma model* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Yi Su (UM) *Electrical Networks, Electrical Lie Group and Lie Algebra* -- 3088 East Hall |
| 5:15pm-6:30pm | **Teaching Mathematics** -- Grace Kennedy (UCSB) *Teaching Math for Elementary School Teachers Through Observation and Inquiry* -- 3096 East Hall |

| Tuesday, January 29, 2013 | |
|---|---|
| 2:10pm-3:00pm | **What is... ?** -- Jean-francois Lafont (Ohio State University) *What is... a homology manifold?* -- 3866 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- Jean-francois Lafont (Ohio State University) *Isomorphism conjectures in K-theory* -- 1360 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Wednesday, January 30, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Robert Walker (UM) *The Saga of Fermat's Last Theorem* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Sarah Mayes (University of Michigan) *Applications of Commutative Algebra: Integer Programming* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Brittan Farmer (University of Michigan) *Interatomic forces* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Brian Lehmann (Rice) *Big cycles and volume functions* -- 3088 East Hall |

| Thursday, January 31, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Topology** -- Priyam Patel (Rutgers) *Quantifying Residual Finiteness and LERF-ness in Terms of Geometric Data* -- 3866 East Hall |
| 3:00pm-4:00pm | **Commutative Algebra** -- Daniel Erman (University of Michigan) *Laurent Polynomials and Eulerian Numbers* -- 3096 East Hall |
| 4:00pm-5:00pm | **Math Club** -- David Speyer (Univ. of Michigan) *Unsolvability of the quintic equation* -- Nesbitt Room |
| 4:00pm-5:00pm | **Differential Equations** -- Moritz Reintjes (Univ. Regensburg) *Points of General Relativistic Shock Wave Interaction are "Regularity Singularities" where Spacetime is Not Locally Flat* -- 4088 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- Purvi Gupta (University of Michigan) *Deconstructing the Infinity Laplacian* -- 3096 East Hall |

| Friday, February 01, 2013 | |
|---|---|
| 10:00am-11:00am | **Theoretical Computer Science** -- Atri Rudra (Buffalo) *One algorithm to rule them all: One join query at a time* -- 411 West Hall |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Shravan Veerapaneni (University of Michigan) *A fast algorithm for spherical grid rotations and its application to singular quadrature* -- 1084 East Hall |
| 3:00pm-4:00pm | **Geometry** -- Amie Wilkinson (University of Chicago) *Absolute continuity, exponents, and rigidity* -- 3096 East Hall |
| 4:00pm-6:00pm | **Kottwitz Seminar** -- Charles Stibitz (UM) *Spectra and Cohomology Theories* -- 3088 East Hall |
| 4:10pm-5:00pm | **Combinatorics** -- Andreas Blass (University of Michigan) *Shelah's bipartite matching algorithm* -- 3866 East Hall |

| Monday, February 04, 2013 | |
|---|---|
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Daniel Fiorilli (UM) *Unbounded ranks of elliptic curves, highly biased prime number races and the explicit formula* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Xin Zhou (UM) *Asymptotic Schur decomposition of Veronese Syzygies* -- 4088 East Hall |
| 3:00pm-4:00pm | **Student Geometry/Topology** -- Tengren Zhang (UM) *A Gentle Introduction to Higher Teichmuller Theory* -- 3096 East Hall |
| 4:00pm-5:00pm | **Several Complex Variables** -- Elizabeth Wulcan (U Gothenburg/Chalmers) *Green functions and Segre numbers* -- 3096 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Zhengyu Zong (Columbia) *The two-leg orbifold Gromov-Witten vertex* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Alex Leaf (UM) *The Seymour-Robertson Theorem and Graph Minor Theory* -- 3088 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Tuesday, February 05, 2013 | |
|---|---|
| 4:10pm-5:00pm | **Colloquium Series** -- Joel Smoller (Univ of Michigan) *Gravitation* -- 1360 East Hall |

| Wednesday, February 06, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Jake Levinson (UM) *Local fields and Galois representations* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Zhibek Kadyrsizova (UM) *Tight closure of ideals* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- () *No Talk. Reminder: SIAM Student Conference This Saturday, Feb 9, 1360 EH, 10:00am* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Daniel Erman (UM) *Semiample Bertini theorems over finite fields* -- 3088 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Alexander Powell (Vanderbilt University) *Consistent reconstruction and some geometry of random polytopes* -- 4096 East Hall |

| Thursday, February 07, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Commutative Algebra** -- Luis Nunez-Betancourt (University of Michigan) *Associated primes of local cohomology of flat extensions with regular fibers* -- 3096 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Jinho Baik (Univ. of Michigan) *Longest Monotone Subsequences* -- Nesbitt Room |
| 4:10pm-5:20pm | **Analysis/Probability Learning Seminar** -- Alexander Powell (Vanderbilt University) *Consist reconstruction and some geometry of random polytopes* -- 4096 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- Derek Wood (University of Michigan) *Strichartz Estimates* -- 3096 East Hall |

| Friday, February 08, 2013 | |
|---|---|
| 10:00am-11:00am | **Theoretical Computer Science** -- Qi Cheng (University of Oklahoma) *On the Decodability of Primitive Reed-Solomon Codes* -- 411 West Hall |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Pej Rohani (Ecology and Evolutionary Biology, University of Michigan) *Unmasking the interaction between influenza and bacterial pneumonia* -- 1084 East Hall |
| 4:00pm-6:00pm | **Kottwitz Seminar** -- Charles Stibitz (UM) *Spectra and Cohomology Theories, part 2* -- 3088 East Hall |
| 4:10pm-5:00pm | **Combinatorics** -- Michael Shapiro (Michigan State University) *Growth rate classification for cluster algebras* -- 3866 East Hall |

| Monday, February 11, 2013 | |
|---|---|
| 12:00pm-1:00pm | **Mathematical Biology** -- Allen Liu (Dept of Mechanical Engineering, University of Michigan) *Systems analysis of clathrin-coated pit dynamics* -- 335 West Hall |
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- AVAILABLE () *TBA* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Nic Ford (UM) *Positroid varieties and Schubert calculus* -- 4088 East Hall |
| 3:00pm-4:00pm | **Student Geometry/Topology** -- Andrew Zimmer (UM) *Random walks on discrete subgroups of Lie groups* -- 3096 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Todor Milanov (IPMU) *The local Eynard-Orantin recursion in Gromov--Witten theory* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Charlotte Chan (UM) *Chevalley's Theorems: Representations of Lie Groups and Invariants of Finite Groups* -- 3088 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Tuesday, February 12, 2013 | |
|---|---|
| 4:10pm-5:00pm | **Colloquium Series** -- Ilya Kapovich (University of Illinois at Urbana-Champaign) *(cancelled due to medical reason).* -- 1360 East Hall |

| Wednesday, February 13, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Ari Shnidman (UM) *Galois representations and their deformations* -- 3866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Andre Souza (University of Michigan) *Boussinesq Convection* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Sam Payne (Yale) *Tropicalization of the moduli space of curves* -- 3088 East Hall |

| Thursday, February 14, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Commutative Algebra** -- Mathias Lederer (UniversitÃ¤t Bielefeld) *Geometric Littlewood-Richardson rules* -- 3096 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Alexander Duncan (Univ. of Michigan) *Undecidable Problems* -- Nesbitt Room |
| 4:10pm-6:00pm | **Analysis/Probability Learning Seminar** -- Elena Yudovina (University of Michigan) *The scaling of the Hardy-Littlewood maximal inequality with dimension* -- 4096 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- () *No Talk* -- 3096 East Hall |

| Friday, February 15, 2013 | |
|---|---|
| 10:30am-11:30am | **Theoretical Computer Science** -- Steve Lu () *Distributed Oblivious RAM for Secure Two-Party Computation* -- 3941 BBB/CSE |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Deniz Akcabay (Naval Architecture and Marine Engineering, University of Michigan) *Cantilever beams in axial flows: flutter Instabilities, post-critical dynamics, scaling laws, and energy harvesting applications* -- 1084 East Hall |
| 4:00pm-6:00pm | **Kottwitz Seminar** -- Charles Stibitz (UM) *Spectra and Cohomology Theories, part 3* -- 3088 East Hall |

| Monday, February 18, 2013 | |
|---|---|
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Bianca Viray (Brown University) *Reductions of CM j-invariants modulo p* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Felipe Perez (UM) *The Briancon-Skoda Theorem* -- 4088 East Hall |
| 3:00pm-4:00pm | **Student Geometry/Topology** -- Andrew Schaug (UM) *An outline of basic Hodge theory* -- 3096 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Yongbin Ruan (UM) *Gromov-Witten theory of quotient of quintic 3-fold* -- 4088 East Hall |
| 4:00pm-5:00pm | **Several Complex Variables** -- Alexander Izzo (Bowling Green State / UM) *Generators for Algebras Dense in L^p spaces* -- 3096 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Robert Walker (UM) *An Evening with Lagrange Inversion and Interpolation* -- 3088 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Tuesday, February 19, 2013 | |
|---|---|
| 2:10pm-3:00pm | **What is... ?** -- Joseph Silverman (Brown University) *A whirlwind survey of the arithmetic of elliptic curves* -- 3866 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- Joe Silverman (Brown University) *The dynamical complexity of rational maps and an arithmetic analogue* -- 1360 East Hall |

| Wednesday, February 20, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Gene Kopp (UM) *Zagier's Magic Formulas for Real Quadratic Fields* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Patricia Klein (UM) *Algebraic Statistics* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Olivia Walch (University of Michigan) *Critical Exponents* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Gabi Farkas (Berlin) *Syzygies of torsion bundles and the geometry of the level l modular variety over M_g* -- 3088 East Hall |
| 4:00pm-6:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Ralf Spatzier (U Michigan) *On automorphisms of convex cones I (after Benoist)* -- 3096 East Hall |

| Thursday, February 21, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Commutative Algebra** -- Morgan Brown (University of Michigan) *Finite generation in characteristic $0$ and characteristic $p$* -- 3096 East Hall |
| 4:00pm-5:00pm | **Differential Equations** -- Kevin Zumbrun (Indiana U. ) *CONVEX ENTROPY, HOPF BIFURCATION, AND VISCOUS AND INVISCID SHOCK STABILITY* -- 4088 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Mark Conger (Univ. of Michigan) *Mathematics of Card Shuffling* -- Nesbitt Room |
| 4:10pm-6:00pm | **Analysis/Probability Learning Seminar** -- Fedor Nazarov (Kent State University) *Estimates for the number of real zeroes of random polynomials* -- 4096 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- Rafe Kinsey (University of Michigan) *How to Prove Existence of Nonlinear PDE* -- 3096 East Hall |

| Friday, February 22, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Jun Zhang (Psychology, University of Michigan) *Topological characterization of interval and semi-orders* -- 1084 East Hall |
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Pierre Patie (Cornell University) *Fluctuation theory for completely asymmetric Markov processes* -- 1360 East Hall |
| 4:10pm-5:00pm | **Combinatorics** -- Li Li (Oakland University) *Positivity and tameness in rank 2 cluster algebras* -- 3866 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Monday, February 25, 2013 | |
|---|---|
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Jeffrey Lagarias (UM) *Addition versus Multiplication* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- David Stapleton (UM) *Introduction to Toric Variety Invariants from Algebraic Topology* -- 4088 East Hall |
| 3:00pm-4:00pm | **Student Geometry/Topology** -- Russell Ricks (UM) *Patterson-Sullivan Theory* -- 3096 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Huai-Liang Chang (HKUST) *On algebraic geometric construction of enumerative invariants* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Michael Chmutov (UM) *Combinatorial Hopf Algebras* -- 3088 East Hall |
| 5:15pm-6:30pm | **Teaching Mathematics** -- Michael Von Korff (Reasoning Mind) *Mathematical Knowledge for Online Instruction* -- 3096 East Hall |

| Tuesday, February 26, 2013 | |
|---|---|
| 4:10pm-5:00pm | **Colloquium Series** -- Guillaume Bal (Columbia University) *Equations with random coefficients and theories of random fluctuations.* -- 1360 East Hall |

| Wednesday, February 27, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Brandon Carter (UM) *The Herbrand-Ribet Theorem* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Luis Nunez-Betancourt (UM) *The Hilbert-Kunz multiplicity* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Yee Chee See (University of Michigan) *Turbulent Combustion Modeling* -- 4088 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Jun Li (Stanford) *Categorification of DT invariants and GV numbers (Joint with Algebraic geometry seminar)* -- 3088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Jun Li (Stanford) *Categorification of DT invariants and GV numbers* -- 3088 East Hall |
| 4:00pm-6:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Ralf Spatzier (U Michigan) *Automorphisms of Convex Projective Cones* -- 3096 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Artem Zvavitch (Kent State University) *Some remarks on Mahler's conjecture for convex bodies* -- 4096 East Hall |

| Thursday, February 28, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Darinka Dentcheva (Stevens Institute of Technology) *Risk-averse optimization via stochastic order constraints* -- 1360 East Hall |
| 3:00pm-4:00pm | **Commutative Algebra** -- Jesse Burke (UCLA) *Graded matrix factorizations and complete intersections* -- 3096 East Hall |
| 4:00pm-5:00pm | **Differential Equations** -- Tai-Ping Liu (Academia Sinica, Taipei) *Solving Boltzmann Equation - The Green's function approach* -- 4088 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Igor Kriz (Univ. of Michigan) *The Beauty of Statistical Tests* -- Nesbitt Room |
| 4:00pm-5:30pm | **Logic** -- Scott Schneider (University of Michigan) *Countable locally nilpotent group actions and hyperfinite equivalence relations* -- 2866 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- Joe Roberts (University of Michigan) *Ill Posed Problems* -- 3096 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Friday, March 01, 2013 | |
|---|---|
| 10:00am-11:00am | **Theoretical Computer Science** -- Ely Porat (BIU/UM) *Sketching For Big Data Recommender Systems Using Fast Pseudo-Random Fingerprints* -- 411 West Hall |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- John Boyd (Atmospheric, Oceanic, and Space Sciences, University of Michigan) *Hermite function interpolation on a finite interval and the interrelationships of polynomial and radial basis functions* -- 1084 East Hall |
| 4:00pm-6:00pm | **Kottwitz Seminar** -- Charle Stibitz (UM) *Spectra and Cohomology Theories, part 4* -- 3088 East Hall |
| 4:10pm-5:00pm | **Combinatorics** -- Alexander Barvinok (University of Michigan) *Thrifty approximations of convex bodies by polytopes* -- 3866 East Hall |

| Tuesday, March 05, 2013 | |
|---|---|
| 4:10pm-5:00pm | **Colloquium Series** -- Winter Break () *TBA* -- 1360 East Hall |

| Wednesday, March 06, 2013 | |
|---|---|
| 3:10pm-4:00pm | **Student AIM Seminar** -- () *Spring Break. No Talk* -- 4088 East Hall |

| Thursday, March 07, 2013 | |
|---|---|
| 5:10pm-6:00pm | **Student Analysis** -- () *No Talk (Spring Break)* -- 3096 East Hall |

| Monday, March 11, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Geometry/Topology** -- Tengren Zhang (UM) *What are Affine Spheres?* -- 3096 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Si Li (BU) *Landau-Ginzburg B-model at higher genus* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Kevin Carde (UM) *Distributive Lattices* -- 3088 East Hall |
| 5:15pm-6:30pm | **Teaching Mathematics** -- Michael Weiss (Michigan State Univ) *More than Problem-Solving: Mathematical Practices Beyond the Common Core* -- 3096 East Hall |

| Tuesday, March 12, 2013 | |
|---|---|
| 2:00pm-3:30pm | **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404 |
| 2:10pm-3:00pm | **What is... ?** -- Andreas Blass (University of Michigan) *What Is ... Ingleton's Inequality?* -- 3866 East Hall |
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Steve Shreve (Carnegie Mellon University) *Diffusion scaling of a limit-order book model* -- 1360 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- Mike Hopkins (Harvard University) *Ziwet Lectures: Lecture I: The Kervaire invariant problem* -- 1360 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Wednesday, March 13, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Topology** -- Michael Hopkins (Harvard University) *Ziwet Lecture II: Equivariant Homotopy Theory and the Solution to the Kervaire Invariant Problem* -- 1372 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Sarah Mayes (UM) *Applications of commutative algebra to game theory* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Xiaolin Wang (University of Michigan) *A numerical study of vorticity-enhanced heat transfer* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Anton Khoroshkin (Stonybrook) *Syzygies via Lie algebra cohomology* -- 3088 East Hall |
| 4:00pm-5:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Ralf Spatzier (U Michigan) *Benoist' dichotomy on Zariski density* -- 3096 East Hall |

| Thursday, March 14, 2013 | |
|---|---|
| 2:00pm-3:30pm | **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404 |
| 3:00pm-4:00pm | **Commutative Algebra** -- Will Traves (US Naval Academy) *From Pascal's Theorem to Constructible Curves* -- 3096 East Hall |
| 3:00pm-4:00pm | **Topology** -- Michael Hopkins (Harvard University) *Ziwet Lecture III: Equivariant multiplicative closure* -- 3088 East Hall |
| 4:00pm-5:00pm | **Differential Equations** -- Jason Metcalfe (Univ. of North Carolina, Chapel Hill) *Local well-posedness for quasilinear Schrodinger equations with rough data* -- 4088 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Selim Esedoglu (Univ. of Michigan) *Math in Computer Vision* -- Nesbitt Room |
| 4:00pm-5:30pm | **Logic** -- Daniel Hathaway (Univ. of Michigan) *Fusion in Sacks Forcing* -- 2866 East Hall |

| Friday, March 15, 2013 | |
|---|---|
| 12:00am-12:00am | **SPECIAL EVENT** -- () *Graduate Recruitment Weekend* -- Mathematics Atrium |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Andrew Wynn (Imperial College) *Optimal Mode Decomposition: a new technique to analyse fluid flow data* -- 1084 East Hall |
| 3:00pm-4:00pm | **Geometry** -- Dave Futer (Temple ) *Surface quotients of hyperbolic buildings* -- 3096 East Hall |
| 4:10pm-5:00pm | **Combinatorics** -- Bruce Sagan (Michigan State University) *Factoring the characteristic polynomial of a poset* -- 3866 East Hall |

| Saturday, March 16, 2013 | |
|---|---|
| 12:00am-12:00am | **SPECIAL EVENT** -- () *Graduate Recruitment Weekend* -- Mathematics Atrium |

| Monday, March 18, 2013 | |
|---|---|
| 12:00pm-1:00pm | **Mathematical Biology** -- Gennady Cymbalyuk (Neuroscience Institutue, Georgia State University) *Cellular mechanisms controlling temporal characteristics of neuronal activity* -- 335 West Hall |
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Ari Shnidman (UM) *p-adic heights of algebraic cycles* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Brooke Ullery (UM) *Introduction to Boij-Soderberg Theory* -- 4088 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Simon Rose (Queens University) *Counting Hyperelliptic curves in Abelian surfaces with Quasi-modular forms* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Chris Fraser (UM) *Statistical Mechanics and Enumerative* |

*Combinatorics* -- 3088 East Hall

| Tuesday, March 19, 2013 | |
|---|---|
| 2:00pm-3:30pm | **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404 |
| 2:10pm-3:00pm | **What is... ?** -- John Schotland (University of Michigan) *What is ... the inverse problem?* -- 3866 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- David Fisher (Indiana University ) *Quasi-isometric rigidity of polycyclic groups* -- 1360 East Hall |

| Wednesday, March 20, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Julian Rosen (UM) *TBA* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Linquan Ma (UM) *Colon-capturing* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Hamed Razavi (University of Michigan) *Bipedal Robots* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Morgan Brown (UM) *The McKay correspondence* -- 3088 East Hall |
| 4:10pm-6:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Andrew Zimmer (U Michigan) *Dynamics of the geodesic flow on divisible strictly convex sets* -- 3096 East Hall |

| Thursday, March 21, 2013 | |
|---|---|
| 12:00am-12:00am | **Topology** -- Asaf Hadari (Yale) *Homological Shadows of Attracting laminations* -- 3866 East Hall |
| 1:00pm-3:00pm | **SPECIAL EVENT** -- Stephen DeBacker (UM) *Working Seminar on Representation Theory* -- 1060 East Hall |
| 2:00pm-3:30pm | **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404 |
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Igor Cialenco (Department of Applied Mathematics, Illinois Institute of Technology) *Dynamic Conic Finance* -- 1360 East Hall |
| 3:00pm-4:00pm | **Commutative Algebra** -- Jenna Rajchgot (University of Michigan) *Doubly Universal Grobner bases* -- 3096 East Hall |
| 4:00pm-5:00pm | **Differential Equations** -- Michael Kiessling (Rutgers University) *Nonlinear electromagnetism and the problem of point charge motion* -- 4088 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Daniel Erman (Univ. of Michigan) *Hilbert's Third Problem* -- Nesbitt Room |
| 4:00pm-5:30pm | **Logic** -- Andreas Blass (Univ. of Mich.) *Sacks property and ultrafilter preservation* -- 2866 East Hall |
| 5:00pm-6:00pm | **SPECIAL EVENT** -- () *Social Hour* -- Mathematics Atrium |

| Friday, March 22, 2013 | |
|---|---|
| 10:00am-11:00am | **Theoretical Computer Science** -- Arnab Bhattacharyya (DIMACS) *Every locally characterized affine-invariant property is testable* -- 411 West Hall |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Aaron King (Ecology and Evolutionary Biology, University of Michigan) *Using mathematics to explain and forecast infectious disease dynamics* -- 1084 East Hall |
| 3:00pm-4:00pm | **Geometry** -- Siu-Cheong Lau (Harvard) *An introduction to SYZ mirror symmetry* -- 3096 East Hall |
| 4:10pm-5:00pm | **Combinatorics** -- Michael Chmutov (University of Michigan) *Type A molecules are of Kazhdan-Lusztig type* -- 3866 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Monday, March 25, 2013 | |
|---|---|
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Igor Dolgachev (UM) *Cayley property of algebraic groups* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- David Stapleton (UM) *Toric Blow-ups* -- 4088 East Hall |
| 3:00pm-4:00pm | **Student Geometry/Topology** -- David Renardy (UM) *How to compute hyperbolic volume* -- 3096 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Siu-Cheong Lau (Harvard) *Open mirror theorem and crepant resolutions* -- 4088 East Hall |

| Tuesday, March 26, 2013 | |
|---|---|
| 2:00pm-3:30pm | **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404 |
| 2:10pm-3:00pm | **What is... ?** -- Mattias Jonsson (Univ of Michigan) *What is a Berkovich space* -- 3866 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- Domingo Toledo (University of Utah) *Geometry of Period Domains* -- 1360 East Hall |

| Wednesday, March 27, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Suchandan Pal (UM) *TBA* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Jenna Rajchgot (UM) *F-splitting, Grobner bases, and applications* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Yen Ting Lin (University of Michigan) *On Interaction between Stochasticity and Nonlinearity: In the Context of Stochastic Competitive Population Dynamics* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- John Lesieutre (MIT) *A divisor with non-closed diminished base locus* -- 3088 East Hall |
| 4:00pm-5:30pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Andrew Zimmer (U Michigan) *More on convex divisible sets* -- 3096 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Mykhaylo Shkolnikov (Berkeley) *Large deviations for diffusions interacting through their ranks* -- 4096 East Hall |

| Thursday, March 28, 2013 | |
|---|---|
| 2:00pm-3:30pm | **Geometry & Physics** -- Kentaro Hori (IPMU) *D-brane (FRG Special Lectures)* -- Randall Lab 4404 |
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Mykhaylo Shkolnikov (UC Berkeley) *Asymmetrically colliding Brownian particles in stochastic portfolio theory and beyond* -- 1360 East Hall |
| 3:00pm-4:00pm | **Topology** -- Thomas Koberda (Yale) *Curve complexes for right-angled Artin groups.* -- 3866 East Hall |
| 3:00pm-4:00pm | **Commutative Algebra** -- Florian Enescu (Georgia State University) *On strong test ideals* -- 3096 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Scott Schneider (Univ. of Michigan) *The Banach-Tarski Paradox* -- Nesbitt Room |
| 4:00pm-5:00pm | **Differential Equations** -- Cindy Keeler (UMICH Dept. Physics) *From Navier-Stokes to Einstein* -- 4088 East Hall |
| 4:10pm-6:00pm | **Analysis/Probability Learning Seminar** -- Pierre Youssef (Paris-Est Marne-la Vallee University) *On some column selection problems and applications* -- 4096 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- Jeff Calder (University of Michigan) *A Hamilton-Jacobi equation for the continuum limit of non-dominated sorting* -- 3096 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Friday, March 29, 2013 | |
|---|---|
| 1:00pm-2:00pm | **RTG Workshops/Lectures** -- Vadim Kaimanovich (U Ottawa) *Random walks and Poisson boundaries; entropy and the Liouville property* -- B 844, East Hall |
| 2:15pm-3:15pm | **RTG Workshops/Lectures** -- Anders Karlsson (U Geneva) *An ergodic theorem for noncommuting products* -- B 844 |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Brian Arbic (Earth and Environmental Sciences, University of Michigan) *Impact of stratification and climatic perturbations to stratification on barotropic tides* -- 1084 East Hall |
| 4:00pm-5:00pm | **RTG Workshops/Lectures** -- Alex Furman (UIC) *Products of random matrices: Lyapunov exponents and stationary measures* -- B 844 |
| 4:10pm-5:00pm | **Combinatorics** -- Kevin Carde (University of Michigan) *Cluster structures on mixed invariant rings, and related combinatorics* -- 3866 East Hall |

| Saturday, March 30, 2013 | |
|---|---|
| 9:00am-10:00am | **RTG Workshops/Lectures** -- Vadim Kaimanovich (U Ottawa) *Boundary convergence and identification; applications to the mapping class group* -- B 844 |
| 10:15am-11:00am | **RTG Workshops/Lectures** -- Giulio Tiozzo (Harvard U) *Geodesic ray tracking for random walks on groups* -- B 844 |
| 11:15am-12:15pm | **RTG Workshops/Lectures** -- Alex Furman (UIC ) *Lyapunov exponents: positivity of the top exponent, simplicity of the spectrum, regularity* -- B 844 |
| 1:30pm-2:30pm | **RTG Workshops/Lectures** -- Moon Duchin (Tufts U) *Random TeichmÃ¼ller geodesics* -- B 844 |
| 2:45pm-3:30pm | **RTG Workshops/Lectures** -- Andrew Zimmer (U Michigan) *The Poisson and Martin boundary of a harmonic manifold* -- B 844 |
| 4:00pm-5:00pm | **RTG Workshops/Lectures** -- Anders Karlsson (U Geneva) *An ergodic theorem for noncommuting products II* -- B 844 |

| Monday, April 01, 2013 | |
|---|---|
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Alexei Oblomkov (University of Massachusetts Amherst) *The elliptic Affine Springer Fibers in type A and the rational Cherednik Algebras* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Robert Auffarth (Pontificia Universidad CatÃ³lica de Chile) *Elliptic curves in abelian varieties* -- 4088 East Hall |
| 3:00pm-4:00pm | **Student Geometry/Topology** -- Patrick Boland (UM) *SL(2,Z)\SL(2,R)* -- 3096 East Hall |
| 4:00pm-5:00pm | **Geometry** -- Jeff Danciger (UT Austin) *Geometric transitions in Lorentzian geometry I* -- EH 3096 |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Rachel Karpman (UM) *Puzzles and (equivariant) cohomology of Grassmannians* -- 3088 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Tuesday, April 02, 2013 | |
|---|---|
| 2:10pm-3:00pm | **What is... ?** -- Bob Griess (Univ of Michigan) *What is moonshine?* -- 3866 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- Max Glick (Univ of Michigan) *Sumner Myers colloquium: The pentagram map and Y-patterns* -- 1360 East Hall |

| Wednesday, April 03, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Adam Kaye (UM) *Damerell's Theorem on L-functions of Elliptic curves with CM* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Luis Nunez-Betancourt (UM) *F-purity* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Alfredo Wetzel (University of Michigan) *Whitham Modulation Theory* -- 4088 East Hall |
| 4:00pm-6:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Jeff Danciger (UT Austin) *Geometric transitions in Lorentzian geometry* -- 3096 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Tamara Grava (SISSA (Italy)) *Hamiltonian perturbation of elliptic and hyperbolic systems: universality of critical behaviour* -- 4096 East Hall |

| Thursday, April 04, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Jin Ma (USC) *Pathwise Stochastic Taylor Expansion and Forward Path-Dependent PDEs* -- 1360 East Hall |
| 3:00pm-4:00pm | **Commutative Algebra** -- Mel Hochster (University of Michigan) *Ideals and algebras generated by forms of degree at most 4 in polynomial rings* -- 3096 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Daniel Fiorilli (Univ. of Michigan) *Prime Number Races* -- Nesbitt Room |
| 4:00pm-5:00pm | **Differential Equations** -- Chong-Qing Cheng (Nanjing Univ.) *Dynamical Instability of nearly integrable Hamiltonian systems* -- 4088 East Hall |
| 4:00pm-5:30pm | **Logic** -- Andreas Blass (Univ. of Michigan) *Sacks forcing and ultrafilter preservation* -- 2866 East Hall |
| 4:10pm-6:00pm | **Analysis/Probability Learning Seminar** -- Roman Vershynin (UM) *Density of eigenvalues of random matrices (after Erdos, Schlein and Yau)* -- 4096 East Hall |

| Friday, April 05, 2013 | |
|---|---|
| 10:30am-11:30am | **Theoretical Computer Science** -- Aaron Snook (U-M) *An Optimal Lower Bound on the Number of Variables for Graph Identification* -- 3941 BBB/CSE |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Denis Zorin (Courant Institute of Mathematical Sciences, New York University) *O(N) direct solver for integral equations on 2D domains* -- 1084 East Hall |
| 3:00pm-4:00pm | **Geometry** -- Gabor Szekelyhidi (Notre Dame) *Filtrations and test-configurations* -- 3096 East Hall |
| 4:00pm-6:00pm | **Kottwitz Seminar** -- Charles Stibitz (UM) *Spectra and Cohomology Theories, part 5* -- 3088 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Monday, April 08, 2013 | |
|---|---|
| 3:00pm-5:00pm | **Group, Lie and Number Theory** -- Pierre Debes (Universite Lille 1, France) *The Inverse Galois Problem with Local Conditions* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Robert Silversmith (UM) *Excess Intersections* -- 4088 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Wenxuan Lu (Upenn) *Stability Conditions and Mirror Symmetry of K3 Surfaces in Attractor Backgrounds* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- Elena Yudovina (UM) *A character-building way of computing chromatic polynomials* -- 3088 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Antti Knowles (Courant Institute) *Quantum diffusion and delocalization for random band matrices [Combined with Differential Equations Seminar]* -- 1360 East Hall |
| 4:10pm-5:00pm | **Differential Equations** -- Antti Knowles (Courant Institute ) *Quantum diffusion and delocalization for random band matrices. COMBINED WITH ANALYSIS/PROBABILITY SEMINAR.* -- 1360 East Hall |

| Tuesday, April 09, 2013 | |
|---|---|
| 4:10pm-5:00pm | **Colloquium Series** -- Igor Dolgachev (University of Michigan) *Algebra, geometry and topology of Cremona groups* -- 1360 East Hall |

| Wednesday, April 10, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Hunter Brooks (UM) *TBA* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Ashley Wheeler (UM) *Introduction to Semigroup Rings* -- 2866 East Hall |
| 3:10pm-4:00pm | **Student AIM Seminar** -- Richard B. Choroszucha (University of Michigan) *Linear Model Order Reduction In Model Predictive Control* -- 4088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Paolo Aluffi (FSU) *Segre classes of monomial subschemes* -- 3088 East Hall |
| 4:00pm-5:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Andrew Zimmer (U Michigan) *More on convex divisible sets* -- 3096 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Yuliy Baryshnikov (University of Illinois, Urbana-Champaign) *Hadwiger's theorem for functions* -- 4096 East Hall |

| Thursday, April 11, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Thaleia Zariphopoulou (Oxford University and UT Austin.) *Postponed to Fall* -- 1360 East Hall |
| 3:00pm-4:00pm | **Commutative Algebra** -- Diane Maclagan (University of Warwick) *Tropical Commutative Algebra* -- 3096 East Hall |
| 4:00pm-5:00pm | **Differential Equations** -- Andreas Grotz (Harvard) *On the initial value problem for causal variational principles* -- 4088 East Hall |
| 4:00pm-5:00pm | **Math Club** -- Hala Shehadeh (Univ. of Michigan) *Convexity* -- Nesbitt Room |
| 4:00pm-5:00pm | **Algebraic Geometry** -- Johannes Nicaise (Leuven) *The Kontsevich-Soibelman skeleton of a degeneration of Calabi-Yau varieties* -- 3088 East Hall |
| 5:10pm-6:00pm | **Student Analysis** -- Jeremy Hoskins (University of Michigan) *TBA* -- 3096 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Friday, April 12, 2013 | |
|---|---|
| 10:00am-11:00am | **Theoretical Computer Science** -- Aram Harrow (MIT) *High-degree graphs cannot be used for a quantum PCP* -- 411 West Hall |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Yuan Young (New Jersey Institute of Technology) *Nonlinear dynamics of a lipid membrane under a DC field* -- 1084 East Hall |
| 3:00pm-4:00pm | **Geometry** -- Livio Flaminio (U Lille) *Cohomology and equidistribution for Abelian actions on nilmanifolds* -- 3096 East Hall |

| Monday, April 15, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Group, Lie and Number Theory** -- Jiarui Fei (UC Riverside) *Categorical Homotopy from Quivers* -- 4096 East Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Zhixian Zhu (UM) *Zariski decomposition* -- 4088 East Hall |
| 4:00pm-5:00pm | **Student Combinatorics Seminar** -- David Benson-Putnins (UM) *Quantum Groups - why are they quantum, and what makes them groups?* -- 3088 East Hall |

| Tuesday, April 16, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Algebraic Geometry** -- Richard Thomas (Imperial College) *The GÃ¶ttsche conjecture* -- 1360 East Hall |
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Umut Cetin (London School of Economics) *Explicit construction of a dynamic Bessel bridge of dimension 3* -- 1096 East Hall |
| 3:10pm-4:00pm | **Colloquium Series** -- Richard Thomas (Imperial College) *Algebraic geometry Spring lectures: The Gottsche conjecture* -- 1360 EH |
| 4:30pm-5:30pm | **Colloquium Series** -- Stephen Smale (Toyota Technological Institute at Chicago) *Mathematics of Protein Folding* -- Forum Hall, Palmer Commons (4th floor) |

| Wednesday, April 17, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Arithmetic** -- Corey Everlove (UM) *Generalized prime numbers and integers* -- 3866 East Hall |
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Ashley Wheeler (UM) *Introduction to Semigroup Rings II* -- 2866 East Hall |
| 4:00pm-6:00pm | **Geometry & Physics** -- Richard Thomas (Imperial College) *See(<a href="http://www.math.lsa.umich.edu/~mmustata/Spring.html">Spring Lectures in Algebraic Geometry</a>)* -- 3088 East Hall |
| 4:00pm-6:00pm | **Algebraic Geometry** -- Richard Thomas (Imperial College) *Stable maps, ideal sheaves and the MNOP conjecture* -- 3088 East Hall |
| 4:00pm-6:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Tengren Zhang (U Michigan) *Convex real projective structures on surfaces* -- 3096 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Pavel Bleher (IUPUI) *Normal matrix model with a cubic potential. The Riemann-Hilbert approach* -- 4096 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Thursday, April 18, 2013 | |
|---|---|
| 2:50pm-4:00pm | **Financial/Actuarial Mathematics** -- Umut Cetin (London School of Economics) *Risk aversion of market makers and asymmetric information* -- 1360 East Hall |
| 3:00pm-4:00pm | **Algebraic Geometry** -- Richard Thomas (Imperial College) *Stable pairs* -- 3088 East Hall |
| 3:00pm-12:00am | **Topology** -- Guillaume Dreyer (Notre Dame) *Parametrizing Hitchin components* -- 3866 |
| 4:00pm-5:00pm | **Math Club** -- Charlie Doering (Univ. of Michigan) *The Paradox of Enrichment* -- Nesbitt Room |
| 4:00pm-5:00pm | **Differential Equations** -- Michael Dabkowski (UMICH Dept. Mathematics ) *Eventual Regularity for Solutions of Supercritical Active Scalar Equations* -- 4088 East Hall |
| 4:00pm-5:30pm | **Logic** -- Ashwini Aroskar (Univ. of Michigan) *Limits, Regularity and Removal for Relational Structures - A Non-standard Approach* -- 2866 East Hall |
| 4:10pm-6:00pm | **Analysis/Probability Learning Seminar** -- Elisabeth Meckes (Case Western Reserve University) *TBA* -- 4096 East Hall |

| Friday, April 19, 2013 | |
|---|---|
| 4:00am-5:00am | **Algebraic Geometry** -- Richard Thomas (Imperial College) *BPS invariants* -- 4088 EH |
| 10:00am-11:00am | **Theoretical Computer Science** -- Mary Wootters (U-M) *What gaussian processes can do for you: applications of probability and geometry in theoretical computer science* -- 411 West Hall |
| 3:00pm-4:00pm | **Applied Interdisciplinary Mathematics** -- Martin Strauss (University of Michigan) *Some open problems in sustainable energy* -- 1084 East Hall |
| 3:00pm-4:00pm | **Geometry** -- Karsten Grove (U Notre Dame) *Tits Geometry and Positive Curvature* -- 3096 East Hall |

| Monday, April 22, 2013 | |
|---|---|
| 12:00pm-1:00pm | **Mathematical Biology** -- Joern Davidsen (Complexity Science Group, University of Calgary) *Inferring Causal Connections and Functional Networks* -- 335 West Hall |
| 3:00pm-4:00pm | **Student Algebraic Geometry** -- Xiaolei Zhao (UM) *Dual cone of pseudo-effective divisor cone* -- 4088 East Hall |
| 4:00pm-5:00pm | **Several Complex Variables** -- Kenneth Koenig (Ohio State) *Maximal hypoellipticity for the $\overline{\partial}$-Neumann problem* -- 3096 East Hall |
| 4:00pm-5:00pm | **Analysis/Probability** -- Dong Wang (National University of Singapore) *Non-intersecting Brownian motions on the circle and discrete Gaussian orthogonal polynomials* -- 3866 EH (Special date!) |
| 4:10pm-5:00pm | **Group, Lie and Number Theory** -- Hunter Brooks (UM) *Generalized Heegner cycles, Shimura curves, and special values of p-adic L-functions* -- 4096 East Hall |

| Tuesday, April 23, 2013 | |
|---|---|
| 2:10pm-3:00pm | **What is... ?** -- Bill Fulton (Univ of Michigan) *What is ... a bad math talk?* -- 3866 East Hall |
| 3:00pm-4:00pm | **Financial/Actuarial Mathematics** -- Sebastian Jaimungal (University of Toronto) *Robust Market Making* -- 1360 East Hall |
| 4:10pm-5:00pm | **Colloquium Series** -- Andreas Blass (Univ of Michigan) *The Continuum Hypothesis and Its Enemies* -- 1360 East Hall |

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

| Wednesday, April 24, 2013 | |
|---|---|
| 3:00pm-4:00pm | **Student Commutative Algebra** -- Angelica Benito (UM) *Test ideals in quotients of F-finite regular local rings* -- 2866 East Hall |
| 4:00pm-6:00pm | **RTG Working Seminar on Geometry, Dynamics and Topology** -- Tengren Zhang (U Michigan) *More on convex projective structures on surfaces* -- 3096 East Hall |
| 4:10pm-5:00pm | **Analysis/Probability** -- Hoi Nguyen (Yale University) *Random matrix: Law of the determinant* -- 4096 East Hall |

| Tuesday, April 30, 2013 | |
|---|---|
| 1:30am-3:30am | **Financial/Actuarial Mathematics** -- Yu-Jui Huang (UM) *Thesis Defense: Topics in Stochastic Control with Applications to Finance* -- 1096 East Hall |

| Wednesday, May 01, 2013 | |
|---|---|
| 12:00pm-1:00pm | **Theoretical Computer Science** -- Valerie King (University of Victoria) *Dynamic Graph Connectivity in Polylogarithmic Worst Case Time* -- 4941 BBB/CSE |

| Friday, May 03, 2013 | |
|---|---|
| 10:30am-11:30am | **Theoretical Computer Science** -- Jared Saia (University of New Mexico) *Byzantine Agreement in Polynomial Expected Time* -- 3941 BBB/CSE |

| Thursday, May 16, 2013 | |
|---|---|
| 12:00am-12:00am | **Algebraic Geometry** -- () *Conference in Algebraic Geometry* -- TBA |

| Friday, May 17, 2013 | |
|---|---|
| 12:00am-12:00am | **Algebraic Geometry** -- () *Conference in Algebraic Geometry* -- |

| Saturday, May 18, 2013 | |
|---|---|
| 12:00am-12:00am | **Algebraic Geometry** -- () *Conference in Algebraic Geometry* -- 3088 East Hall |

| Sunday, May 19, 2013 | |
|---|---|
| 12:00am-12:00am | **Algebraic Geometry** -- () *Conference in Algebraic Geometry* -- 3088 East Hall |

| Thursday, May 23, 2013 | |
|---|---|
| 4:10pm-5:20pm | **Analysis/Probability Learning Seminar** -- Raja Giryes (Technion, Israel) *The analysis cosparse model for signals and images* -- 4096 East Hall |

## Abstracts

**Financial/Actuarial Mathematics**
**Thursday, January 10, 2013, 2:30pm-7:00pm**
**1360 East Hall**
**Ross Kravitz (UM)**
*Thesis Defense: Problems in Optimal Stopping and Control*

I will describe the three problems that I studied in my thesis, and discuss two of them in some detail. The first problem comes from mathematical finance, and involves the stability of exponential utility maximization with respect to market perturbations. We use the theory of BMO martingales to obtain conditions under which stability is guaranteed. The second problem comes from mathematical statistics, and is a extension of the classical sequential analysis problem of verifying a statistical hypothesis with a minimum number of observations. We consider an infinite sequence of Brownian Motions which have drift equal to zero or one, which may only be observed one at a time. If our goal is to find a B.M. with drift one, how should we observe the channels, and at what confidence threshold should we stop observation?

**Commutative Algebra**
**Thursday, January 10, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Greg Muller (Louisiana State University)**
*Locally acyclic cluster algebras*

Cluster algebras are combinatorially-defined algebras with distinguished elements called cluster variables, which satisfy a remarkable array of special properties. Cluster algebras have been discovered in the function algebras of many classically-studied spaces, such as spaces of matrices, Grassmannians, and decorated Teichmuller spaces. We will study general cluster algebras geometrically, by considering certain localizations which are naturally simpler cluster algebras. When a cluster algebra can be covered (geometrically) by sufficiently simple cluster algebras, it is `locally acyclic'. This includes `most' cluster algebras coming from marked surfaces, while still allowing many results to be generalized from the acyclic case.

**Differential Equations**
**Thursday, January 10, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Benjamin Dodson (Berkeley)**
*Mass critical nonlinear Schrodinger equation*

The study of the nonlinear Schrodinger equation is motivated by many physical phenomena, in particular quantum mechanics. Hence it is natural to consider square integrable initial data, that is data with finite mass. I will describe my recent results about what is called the mass critical case.

**Applied Interdisciplinary Mathematics**
**Friday, January 11, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Bogdan Vioreanu (University of Michigan)**
*Spectra of multiplication operators as a numerical tool*

We introduce a numerical procedure for the construction of interpolation and quadrature formulae on bounded regions in the plane. The construction is based on the behavior of spectra of certain multiplication operators and leads to nodes which are inside a prescribed region in R^2 . The resulting interpolation schemes are numerically stable and the quadrature formulae have positive weights and almost (but not quite) optimal numbers of nodes. The performance of the algorithm is illustrated by several numerical examples and applications.

**Mathematical Biology**
**Monday, January 14, 2013, 12:00pm-1:00pm**
**335 West Hall**
**Silas Alben (University of Michigan)**
*Mechanical models of fish and krill swimming*

We will give an overview of a few swimming problems with biological applications. First, we present a model of fish fin mechanics and solve a simple optimization problem for fish fins: what distributions of elastic components maximize the stiffness of the fin? We then discuss the resonant properties of flexible beams in fluid flows, as models for fish fins and bodies during swimming. Finally, we will discuss a simple model of krill swimming which asks: how should the krill coordinate the motions of its appendages for fast and efficient swimming?

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Group, Lie and Number Theory**
**Monday, January 14, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Florian Sprung (Brown University)**
*Pairs of p-adic analogues of the conjectures of Birch and Swinnerton-Dyer*

The classical conjectures of Birch and Swinnerton-Dyer relate the behavior of the Hasse-Weil L-function of an elliptic curve to its Q-rational points. For primes of good reduction, there are p-adic analogues of these conjectures due to Mazur, Tate, and Teitelbaum (ordinary case), and due to Bernardi and Perrin-Riou (supersingular case). In this talk, we would like to present a pair of convenient p-adic L-functions that can be used to rewrite (and thus unite) their conjectures. These p-adic L-functions provide us with growth formulas for the Tate-Shafarevich group along the cyclotomic Z_p extension. If time permits, there will be a picture describing the analogous behavior for weight two modular forms.

**Student Algebraic Geometry**
**Monday, January 14, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Zhixian Zhu (UM)**
*An Invitation to Fujita's Conjectures 1*

Let X be a smooth projective variety and A an ample line bundle on X. Fujita conjectured how large m we must choose to have the adjoint linear series |K_X+mA| globally generated or very ample. In this talk, we will do the baby case of Fujita's Conjectures for curves by using Riemann-Roch and mention some results for higher dimensional varieties. For instance, Fujita's Conjectures in positive
characteristic or for toric varieties will be covered later in our student seminar.

**Geometry & Physics**
**Monday, January 14, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Steffen Marcus (Utah)**
*Computations and comparisons for double ramification classes on the moduli space of curves*

Double Hurwitz numbers can be defined geometrically as a weighted count of covers of the projective line with special ramification conditions. Double ramification classes are Chow classes on the moduli space of curves that give a geometric generalization of these numbers. In this talk I will discuss the two main approaches for constructing these classes. We will see how the two approaches compare, how the classes may be expressed in the tautological ring (thanks to recent work of Hain, and Grushevsky-Zakharov), and how this comparison relates to other results in Hurwitz theory. This is joint and continuing work with Renzo Cavalieri and Jonathan Wise.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Several Complex Variables**
**Monday, January 14, 2013, 4:00pm-5:00pm**
**3096 East Hall**
**Tuyen Truong (Syracuse)**
*On automorphisms of blowups of projective manifolds*

In the talk, I will give a heuristic argument to show that for a "generic" compact K\"ahler manifold of dimension at least 3, its automorphism group Aut(X) has only finitely many connected components. In particular, any automorphism of X has topological entropy zero. Some general criteria will be introduced, and many explicit examples will be given in the case X--->X_0 is a finite composition of blowups along smooth centers. Here the projective manifold X_0 can be either of Picard number 1, or have anti-ample canonical divisor, or be a hyper-K\"ahler manifold. It seems from these examples that if X_0 has Picard number 1 and has dimension at least 3 and X--->X_0 is a finite blowup along smooth centers, then any automorphism of X has topological entropy zero.

**Student Combinatorics Seminar**
**Monday, January 14, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**()**
*Planning and Cookies!*

Come eat cookies and discuss the topics for this semester's Student Combinatorics Seminar!

**What is... ?**
**Tuesday, January 15, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**Peter Miller (Univ of Michigan)**
*What is the inverse-scattering transform?*

The inverse-scattering transform was first discovered in the 1960's by Gardner, Greene, Kruskal, and Miura as a method of solving the initial-value problem for the Korteweg-de Vries equation, a well-known nonlinear partial differential equation modeling (among many other things) the propagation of surface water waves in a channel. It soon became apparent that the method applies more broadly to a wider class of problems of great interest in nonlinear wave theory. I will describe some of the history and then explain how the method can be used to solve the defocusing cubic nonlinear Schr\"odinger equation, as was first discovered by Zakharov and Shabat. As suggested by the name of the method, the key ideas come from the mathematical treatment of the direct and inverse-scattering problems for various linear equations, problems that are of independent interest in applications (see John Schotland's upcoming talk in this seminar). <br />
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Although this will be Part II, with particular emphasis on the representation of the inverse scattering problem as a Riemann-Hilbert problem of complex function theory, I will try to make the talk self-contained for those interested people who may have missed Part I last November.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Colloquium Series**
**Tuesday, January 15, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Horng-Tzer Â Yau (Harvard University)**
*Ziwet Lectures: Universality of random matrices and log-gases*

1. Universality of random matrices and log-gases.
(January 15 at 1360EH)

2. Dyson's Brownian and De Georgi-Nash-Moser theory of parabolic regularity.
(January 16 at 1360EH)

Abstract:

Eugene Wignerâ€™s revolutionary vision predicted that the energy levels of large complex quan- tum systems exhibit a universal behavior: the statistics of energy gaps depend only on the basic symmetry type of the model. These universal statistics show strong correlations in the form of level repulsion and they represent a new paradigm of point processes that are characteristically different from the Poisson statistics of independent points.

Simplified models of Wignerâ€™s thesis have recently become mathematically accessible. For mean field models represented by large random matrices with independent entries, the celebrated Wigner-Dyson-Gaudin-Mehta (WDGM) conjecture asserts that the local eigenvalue statistics are universal. For invariant matrix models, the eigenvalue distributions are given by a log-gas with potential $V$ and inverse temperature $\beta = 1, 2, 4$. For $\beta \not \in \{1, 2, 4 \}$, there is no natural random matrix ensemble behind this model, but the analogue of the WDGM conjecture asserts that the local statistics are independent of $V$.

In these lectures, we review the recent solution to these conjectures for both invariant and non-invariant ensembles. We will discuss two different notions of universality in the sense of (i) local correlation functions and (ii) gap distributions.

We will demonstrate that the local ergodicity of the Dyson Brownian motion is the intrinsic mechanism behind the universality. Furthermore, we will show that the universality of gap distribution requires to prove a Holder regularity of a discrete parabolic equation with random coefficients. For this purpose, we incorporate the ideas of parabolic regularity via a De Giorgi-Nash-Moser approach.

**Student Arithmetic**
**Wednesday, January 16, 2013, 3:00pm-4:00pm**
**4096 East Hall**
**()**
*Organizational meeting*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Student Commutative Algebra**
**Wednesday, January 16, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**All (UM)**
*Organizational meeting*

**Student AIM Seminar**
**Wednesday, January 16, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**()**
*Planning Meeting*

**Algebraic Geometry**
**Wednesday, January 16, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Holly Krieger (UIC)**
*TBA*

**Analysis/Probability**
**Wednesday, January 16, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Horng-Tzer Yau (Harvard University)**
*Dyson's Brownian and De Georgi-Nash-Moser theory of parabolic regularity. (Ziwet Lecture II)*

Eugene Wigner's revolutionary vision predicted that the energy levels of large complex quantum systems exhibit a universal behavior: the statistics of energy gaps depend only on the basic symmetry type of the model. These universal statistics show strong correlations in the form of level repulsion and they represent a new paradigm of point processes that are characteristically different from the Poisson statistics of independent points.

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**Topology**
**Thursday, January 17, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Grigori Avramidi (University of Chicago)**
*Symmetries of aspherical manifolds*

I will describe some results bounding the isometry groups of Riemannian metrics on aspherical manifolds and of the lifted metrics on their universal covers. The general theme is that topological properties of an aspherical manifold often restrict the symmetries of an arbitrary complete Riemannian metric on that manifold. I will illustrate this by explaining why on a finite volume irreducible locally symmetric manifold, no metric has more symmetry than the locally symmetric metric. Possibly, I will also discuss why moduli space is a minimal orbifold.

**SPECIAL EVENT**
**Thursday, January 17, 2013, 3:00pm-4:00pm**
**3088 East Hall**
**Paul Gauthier (Univ. of Montreal)**
*Zero-free polynomial approximation and universality of the Riemann zeta-function*

Recently, Johan Andersson has shown that a very natural conjecture on polynomial approximation is equivalent to a conjecture which would extend Voronin's spectacular universality theorem for the Riemann zeta-function.

**Math Club**
**Thursday, January 17, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Matthew Satriano (Univ. of Michigan)**
*The Four Squares Theorem*

It is a remarkable fact that every integer can be written as a sum of four squares. We will present a geometric proof. It uses Minkowski's convex body theorem, which we will explain.

**Differential Equations**
**Thursday, January 17, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Philip Isett (Princeton Univ.)**
*Holder Continuous Euler Flows with Compact Support in Time*

Motivated by the theory of hydrodynamic turbulence, Onsager conjectured in 1949 that solutions to the incompressible Euler equations with Holder regularity less than 1/3 may fail to conserve energy. DeLellis and Szkelyhidi have pioneered an approach to constructing such irregular flows based on an iteration scheme used by Nash to construct "wild" C^1 isometric embeddings. This approach involves correcting "approximate solutions" by adding rapid oscillations which are designed to reduce the error term in solving the equation. In this talk, I will discuss recent work on an improved iteration scheme using nonlinear phase functions for the corrections, which yields solutions in three dimensions with compact support in time and Holder regularity below 1/5.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Logic**
**Thursday, January 17, 2013, 4:00pm-7:00pm**
**2866 East Hall**
**Daniel Hathaway (U. Mich.)**
*Domination of Continuous and Borel functions*

Let X be the set of continuous functions from Baire space to the integers. Let Y be the set of Borel functions from Baire space to the integers. We can order both of these sets with respect to everywhere domination. It is not hard to see that the cofinalities of both of these orderings are uncountable cardinals less than or equal to the cardinal of the continuum. In this talk, we will compute both of these cardinals. Similar results can be obtained by replacing Baire space with, say, the real line with the standard topology.

**Student Analysis**
**Thursday, January 17, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**()**
*Organizational Meeting*

**Theoretical Computer Science**
**Friday, January 18, 2013, 10:30am-11:30am**
**3941 BBB/CSE**
**Seth Pettie (U-M)**
*The Locality of Distributed Symmetry Breaking*

We present new methods for solving several classical symmetry breaking tasks in distributed networks, such as finding maximal independent sets, maximal matchings, and vertex-colorings. This is joint work with Leonid Barenboim, Michael Elkin, and Johannes Schneider. An extended abstract appeared in FOCS 2012. PDF available at http://web.eecs.umich.edu/~pettie/papers/Symmetry-Breaking.pdf.

**Applied Interdisciplinary Mathematics**
**Friday, January 18, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Jean M.-S. Lubuma (University of Pretoria, South Africa)**
*On nonstandard finite-difference schemes in biosciences*

Biological processes that arise in science are very complex. A lot of effort has been and is being made to build differential models that aim at elucidating these phenomena. However, these models cannot be completely solved by analytic techniques. Consequently, reliable numerical simulations are of fundamental importance in gaining some useful insights on the solutions of the differential equations. Of paramount importance for the involved dynamical systems is the design of numerical simulations that replicate their underlying dynamics such as the positivity of solutions, the dissipativity of the systems, the conservation laws, the stability of equilibria.

In this talk we design, analyze and implement nonstandard finite difference (NSFD) schemes for some differential models in biosciences. The NSFD schemes are reliable in three directions. They are topologically dynamically consistent for one-dimensional models. They can replicate the global asymptotic stability of the disease-free equilibrium of the MSEIR model in epidemiology whenever the basic reproduction number is less than 1. They preserve the positivity and boundedness property of solutions of advection-reaction and reaction-diffusion equations.

**Mathematical Biology**
**Friday, January 18, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Jean M.-S. Lubuma (Dept. of Mathematics and Applied Mathematics, University of Pretoria, South Africa)**
*On nonstandard finite-difference schemes in biosciences*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Geometry**
**Friday, January 18, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Christopher Mooney (Bradley University)**
*Old School Topology and Invariants of CAT(0) Group Boundaries*

Recently there has been a surge of interest in "coarse invariants" of groups. This has led geometric group theorists to return to the classical notions of shape equivalence and cell-like equivalence. It has been shown by Bestvina and Geoghegan that all CAT(0) boundaries of a group are shape equivalent, and Bestvina has asked if they all satisfy the stronger notion of cell-like equivalence.

In joint work with Craig Guilbault, we have shown that the answer is "Yes" for an interesting family of groups introduced by Croke and Kleiner. This family includes many of the known examples of groups with multiple boundaries. This talk will begin with a crash-course review of shape equivalence and cell-like equivalence. It will then move to our approach and cover some of the important points in the proof of our theorem.

**Kottwitz Seminar**
**Friday, January 18, 2013, 3:00pm-5:00pm**
**3088 East Hall**
**Ryan Reich (UM)**
*Multiplicity one for automorphic representations of GL_n*

Automorphic representations were introduced by Langlands as one of the basic objects of his Program to give a representation-theoretic basis for understanding number theory. Automorphic forms are a vast generalization of modular forms defined with reference to the ring of adeles of a number or function field, which we will introduce and describe briefly. Our goal is a structural result for the space of automorphic forms for GL_n to the effect that it is multiplicity-free; along the way we will introduce Whittaker functions as a model for automorphic representations and reduce the theorem to a similar multiplicity result for them, using the Fourier transform.

**Combinatorics**
**Friday, January 18, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Tomoo Matsumura (KAIST)**
*(Factorial) Schur functions and weighted Grassmannians*

It is a well-known fact that the so-called Schur functions that form a basis of the algebra of symmetric functions represent the Schubert classes of the cohomology of Grassmannians. After a brief introduction, I will explain how to generalize this fact to the case of weighted Grassmannians.

**Geometry & Physics**
**Monday, January 21, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Tudor Dimofte (IAS)**
*3-Manifolds and 3d Gauge Theories*

By starting with the 6d (2,0) superconformal field theory on a space-time of the form M x R^3, where M is a 3-manifold, one obtains an effective 3-dimensional field theory on R^3 --- thus establishing a correspondence between 3-manifolds M and 3d theories T[M]. The correspondence encodes many beautiful relations between geometry and physics, which I will discuss in the first part of the talk. Ultimately, T[M] should provide a categorification of Chern-Simons theory (i.e. quantum topological invariants) on M.

In the second part of the talk, I will discuss how T[M] (and its partition functions) can actually be computed from ideal triangulations of a large class of 3-manifolds with boundary. Mathematically, this involves studying moduli spaces of framed flat SL(K) connections on tetrahedra and how they glue together.

**Colloquium Series**
**Tuesday, January 22, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Richard Tapia (Rice University)**
*The Isoperimetric Problem Revisited: Extracting a Short Proof of Sufficiency from Euler's 1744 Proof of Necessity*

Our primary objective in this talk is, with the student in mind, to present what we believe to be the shortest, most elementary, and most teachable solution of the isoperimetric problem in history. A secondary objective is to give a brief, but reasonably complete, overview of the remarkable life of the isoperimetric problem, and in the process demonstrate that it has been the most impactful mathematics problem of all time. In 1744 Euler constructed multiplier theory to solve the isoperimetric problem. However, contrary to Euler's belief, satisfaction of his multiplier rule is only a necessary condition and not a sufficient condition to demonstrate that the circle is the solution. Some 135 years later Weierstrass constructed his elegant sufficiency theory for problems in the calculus of variations and used it to provide what is accepted today as the first complete proof that the circle solves the isoperimetric problem. A multitude of sufficiency proofs ensued and in 1995 in a short paper aptly entitled A Short Path to the Shortest Path Peter Lax constructed what is considered to be the shortest and most elementary of all existing proofs. This background material is presented to set the stage for our demonstration that Euler's original necessity proof is but an observation away from establishing a sufficiency proof that we believe to be the shortest and most elementary in the history of the isoperimetric problem. We contemplate to what extend Euler or Lagrange could have, or should have, made our observation. Included is a contrast of our short proof with the Peter Lax short proof and an argument that historically the process of solving the isoperimetric problem was greatly compromised by the fact that the mathematicians of that golden era did not pursue functional convexity and the powerful optimization sufficiency theory that follows directly from this notion.

**Teaching Mathematics**
**Tuesday, January 22, 2013, 5:15pm-6:30pm**
**3096 East Hall**
**Nina White (Univ Michigan, Math Dept and School of Education)**
*The math content sequence for pre-service elementary teachers: students, goals, and methods*

This is an overview of the math content sequence at UM for pre-service elementary teachers. I will talk about the students in the course, the goals for the course (both in content and practices), why those are the goals of the course, and how using inquiry-based learning (IBL) teaching methods supports achievement of those goals. There will be three parts: (I) a general introduction to some of the issues and topics when educating future teachers, (II) a description of the course over the last three years and, in particular, some aspects of the course as I've taught it, and (III) a short description of some research I conducted on the Fall 2012 semester of this course, including some encouraging results.

**Student Arithmetic**
**Wednesday, January 23, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Zach Scherr (UM)**
*Linear Forms in Logarithms*

In this talk I will describe the best known result about Alan Baker's linear forms in logarithms. This result is one of the few effective methods in the area of diophantine approximation. Several applications to diophantine equations will be given.

**Student Commutative Algebra**
**Wednesday, January 23, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Luis Nunez-Betancourt (UM)**
*An overview of tight closure*

Tight closure is an operation on ideal in ring of prime characteristic. Since this theory was introduced by Hochster and Huneke in the 80s, it has been used to study several properties of a ring, for instance, Cohen-Macaulayness. In the last years it has been used to study singularity through test ideals and several invariants. In this talk we will give a general picture of this beautiful theory and its applications.

**Colloquium Series**
**Wednesday, January 23, 2013, 3:10pm-4:00pm**
**B844 East Hall**
**Sarah Koch (Harvard University)**
*An algebraic fingerprint for postcritically finite rational maps*

In the 1980s, William Thurston established his topological characterization of rational maps, one of the central results in the field of holomorphic dynamics. This theorem applies to postcritically finite rational maps (a rational map is postcritically finite if the orbit of every critical point is finite). Given such a rational map, one can define a holomorphic endomorphism of a Teichmueller space associated to it; this endomorphism is called the Thurston pullback map. With the exception of one class of examples, this endomorphism has a unique fixed point, and the eigenvalues of the derivative at this fixed point are all *algebraic*. What do these eigenvalues mean? Do they have any geometric significance in the moduli space of rational maps? In the dynamical plane of the map itself? What algebraic numbers arise this way? We establish some facts about these eigenvalues, and we prove there are no "small eigenvalues" in the case of quadratic polynomials. The general situation is still quite mysterious.

**Student AIM Seminar**
**Wednesday, January 23, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Bobbie Wu (University of Michigan)**
*Fractal Image Compression*

Fractal image compression is an image compression algorithm that reduces redundancy by detecting and encoding self-similarities in an image. While the encoding time is comparatively lengthy, this compression method possess the built-in feature of "resolution-independence", which provides a way to zoom in on images. In this talk, we will present a naive schema of fractal coding, along with the mathematical theory behind the algorithm.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Algebraic Geometry**
**Wednesday, January 23, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Tyler Foster (Yale)**
*Configuration operads via quiver Grassmannians*

The moduli spaces of stable marked rational curves form an operad that plays an important role in the theory of quantum cohomology. In 2006, Chen, Gibney, and Krashen introduced families of moduli spaces closely related to Fulton-MacPherson compactifications, indexed by positive integers d. For each value of d, the corresponding family forms an operad. When d=1, this family recovers the operad of stable marked rational curves. In this talk, I will discuss Chen-Gibney-Krashen spaces, and then introduce a general formalism for constructing abstract operads from certain functors. The operads so obtained contain Chen-Gibney-Krashen operads, along with much else.

**Math Club**
**Thursday, January 24, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Hester Graves (IDA)**
*Drawing and the Projective Plane*

Some geometry we study was inspired by the needs of artists, and this includes projective geometry. This talk has three parts: an overview of the projective plane from a mathematical point of view; a short history of point perspective as used by Renaissance artists; and finally some math and drawing exercises to do (no artistic ability required) that bring the two together.

**Differential Equations**
**Thursday, January 24, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Joe Conlon (Umich)**
*On Global Stability for Lifschitz-Slyozov-Wagner like equations*

This talk is concerned with the stability and asymptotic stability at large time of solutions to a system of equations, which includes the Lifschitz-Slyozov-Wagner (LSW) system in the case when the initial data has compact support. The main result of the paper is a proof of weak global asymptotic stability for LSW like systems. This is joint work with Barbara Niethammer.

**Logic**
**Thursday, January 24, 2013, 4:00pm-5:30pm**
**2866 East Hall**
**Daniel Hathaway (Univ. of Michigan)**
*Domination of Borel functions*

Last week's talk covered the continuous part of the following abstract; this week's talk will cover the Borel part. Let X be the set of continuous functions from Baire space to the integers. Let Y be the set of Borel functions from Baire space to the integers. We can order both of these sets with respect to everywhere domination. It is not hard to see that the cofinalities of both of these orderings are uncountable cardinals less than or equal to the cardinal of the continuum. In this talk, we will compute both of these cardinals. Similar results can be obtained by replacing Baire space with, say, the real line with the standard topology.

**Analysis/Probability Learning Seminar**
**Thursday, January 24, 2013, 4:10pm-6:00pm**
**4096 East Hall**
**Mark Rudelson (University of Michigan)**
*A simple proof of Paouris' inequality*

We present a simple proof of Paouris' large deviation inequality, which was recently found by Adamczak, Latala, Litvak, Oleszkiewicz, Pajor, and Tomczak-Jaegermann. The inequality of Paouris, which states that most of the volume of a convex body is contained within its inertia ellipsoid, became recently one of the major tools of convex geometry.

**Student Analysis**
**Thursday, January 24, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**Matt Jacobs (University of Michigan)**
*The Prime Number Theorem*

The prime number theorem (PNT) is the most important result of analytic number theory. The PNT states that the growth of the prime counting function is asymptotic to the logarithmic integral function li(x). A concrete program to attack PNT was first outlined by Riemann in his amazingly influential 1859 paper "On the number of primes less than a given magnitude". The proof was finally completed independently by Hadamard and de la Valle-Poussin in 1896. Though we now have many different proofs of the prime number theorem, the original proof stands out for its beauty and transparency. The proof is notable for combining many different techniques from both real and complex analysis. I will give a detailed outline of the proof and try to explain what I think are the key ideas.

**Theoretical Computer Science**
**Friday, January 25, 2013, 10:00am-11:00am**
**411 West Hall**
**Travis Martin (U-M)**
*Characterizing Strategic Cascades on Networks*

I will present an in-progress project using game theory to capture a particular network process: cascades. Examples of processes which can be modeled as cascades are product adoption and opinion formation.

All current game theoretic cascade models use agents of limited strategic ability in order to simplify game dynamics. My work investigates the impact of this simplifying assumption by providing bounds on game behavior under with fully strategic agents. Due to the in-progress nature of this work, discussion and understanding will be heavily emphasized.

Current work and a more detailed abstract can be found at:
http://www-personal.umich.edu/~travisbm/publications/travis-prelim.pdf

**Applied Interdisciplinary Mathematics**
**Friday, January 25, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Charlie Doering (University of Michigan)**
*Features of fast living: on the weak selection for longevity in degenerate birth-death processes*

Deterministic descriptions of dynamics of competing species with identical carrying capacities but distinct birth, death, and reproduction rates predict steady state coexistence with population ratios depending on initial conditions. Demographic fluctuations described by a Markovian birth-death model break this degeneracy. A novel large carrying capacity asymptotic theory confirmed by conventional analysis and simulations reveals a weak preference for longevity in the deterministic limit with finite-time extinction of one of the competitors on a time scale proportional to the total carrying capacity. This is joint work with Yen Ting Lin and Hyejin Kim, published in Journal of Statistical Physics 148, 646-662 (2012).

**Mathematical Biology**
**Monday, January 28, 2013, 12:00pm-1:00pm**
**335 West Hall**
**Adam Stinchcombe (Courant Institute of Mathematical Sciences, New York University)**
*General gene-state switching models for stochastic gene expression*

**Group, Lie and Number Theory**
**Monday, January 28, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Baiying Liu (University of Minnesota)**
*Fourier Coefficients of Automorphic Forms and Arthur Classification*

**Student Algebraic Geometry**
**Monday, January 28, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Linquan Ma (UM)**
*Fujita's conjecture in characteristic p*

We will discuss a result by K.E.Smith on Fujita's freeness conjecture in positive characteristic. If X is a smooth projective variety of dimension d over an algebraically closed field of characteristic p and L is an ample globally generated line bundle on X, then K_X+mL is globally generated when m\geq d+1. The original proof uses tight closure, I will present D.Keeler's simplied proof of this result and some generalizations (for example Fujita's very ampleness conjecture in this setting).

**Student Geometry/Topology**
**Monday, January 28, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**David Renardy (UM)**
*Computing the Khovanov Homology*

The focus of this talk will be the basic procedure for computing the Khovanov homology of a knot or link. We will begin by discussing the Jones polynomial, and how to compute it given the "n-cube of resolutions" for a picture of a link with n crossings. Khovanov homology is the so called "categorification" of the Jones Polynomial; the graded Euler characteristic of the Khovanov chain complex yields the Jones polynomial. This talk will be example driven; we will see that two knots sharing the same Jones polynomial can sometimes be differentiated by their Khovanov homology (so Khovanov homology is strictly stronger than the Jones polynomial) and that Khovanov homology can detect the unknot (it is unknown if the Jones polynomial can do this). One of the most appealing and interesting things about Khovanov homology, compared to other knot invariant homology theories, is its computability. We will explicitly compute the Khovanov homology for several knots using Dror Bar-Natan's Mathematica module.

**Geometry & Physics**
**Monday, January 28, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Huazhong Ke (Tsinghua Univ/Michigan)**
*Quantum McKay correspondence via gauged linear sigma model*

In the early 90's, Witten introduced the gauged linear sigma model (GLSM) to study the phase change phenomenon in string theory. Mathematically, we can interprete GLSM as a symplectic reduction, in which charge vectors play an important role. For a local Calabi-Yau $X$, we can use its charge vectors to describe the moduli space of mirror curves, and hence determine the genus-zero (closed) Gromov-Witten invariants. Similar picture also holds for open string invariants. It is observed that for different limit points in the K\"ahler moduli of $X$, it is better to use different charge vectors, which are all $\mathbb Q$-bases of the lattice of invariants. Following this idea, we have proved the quantum McKay correspondence for disc invariants of effective outer legs in semi-projective toric Calabi-Yau $3$-orbifolds, using the recent result of Bohan Fang, Mellisa Liu and Hsian-Hua Tseng. This is joint work with Jian Zhou.

**Student Combinatorics Seminar**
**Monday, January 28, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Yi Su (UM)**
*Electrical Networks, Electrical Lie Group and Lie Algebra*

I will first talk about another class of Lie groups, namely electrical Lie groups introduced by Thomas Lam and Pavlo Pylyavskyy. These groups or rather their positive parts act on the planar electrical networks with boundary vertices specified. The relation in the corresponding Lie algebra is suggested by the star-triangle operation in electrical network. In type A, this group is isomorphic to SP(2n). There is also a decomposition of the group analogous to the one of totally nonnegative matrices in SL(n). Towards the end, I will talk about the generalization of this definition to other Lie types, and some progress in this problem.

**Teaching Mathematics**
**Monday, January 28, 2013, 5:15pm-6:30pm**
**3096 East Hall**
**Grace Kennedy (UCSB)**
*Teaching Math for Elementary School Teachers Through Observation and Inquiry*

Enjoyment of mathematics cannot be taught, but it can be learned if it is not already a part of someone's world view. Encouraging it was an important learning outcome in my course on mathematics for elementary school teachers. We used "Math in the City" videos of children learning mathematics to introduce mathematical concepts that pre-service teachers go on to investigate in our course. I will discuss how to integrate the activities to support my learning outcomes of increased confidence and enjoyment of mathematics.

**What is... ?**
**Tuesday, January 29, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**Jean-francois Lafont (Ohio State University)**
*What is... a homology manifold?*

I'll provide an introduction to homology manifolds and related notions. This talk should be accessible to graduate students; I will only assume familiarity with the first year topology sequence.

**Colloquium Series**
**Tuesday, January 29, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Jean-francois Lafont (Ohio State University)**
*Isomorphism conjectures in K-theory*

I will give a gentle introduction to the Baum-Connes and Farrell-Jones isomorphism conjectures in K-theory. I will assume minimal background, and will start with the definitions of the relevant K-theories. The talk should be accessible to graduate students.

**Student Arithmetic**
**Wednesday, January 30, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Robert Walker (UM)**
*The Saga of Fermat's Last Theorem*

In this talk, we cover highlights in the saga of solving FLT (especially the investigations of Mazur, Frey, Serre, Ribet, and Wiles). More than that, we expect to motivate (most of) the key constructions involved in that line of investigation, in anticipation of more in-depth talks given by Ari and Jake.

**Student Commutative Algebra**
**Wednesday, January 30, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Sarah Mayes (University of Michigan)**
*Applications of Commutative Algebra: Integer Programming*

An integer programming problem is a type of optimization problem in which only integer solutions are allowed. Integer solutions are frequently required in applications, since it is not possible to schedule 4.8 airplanes to fly or to carry 50.6 boxes per order. In this talk we will explore these problems and see how tools from computational commutative algebra, such as Groebner bases, may be used to solve them.

**Student AIM Seminar**
**Wednesday, January 30, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Brittan Farmer (University of Michigan)**
*Interatomic forces*

To understand the structure of molecules or the dynamics of atoms within a material, it is essential to understand the attractive and repulsive forces that exist between atoms. I will describe the Lennard-Jones potential and the Brenner potential and explain the structures they predict. I will mention the application of these forces to molecular dynamics simulation and show some illustrative examples. This talk will be accessible to all graduate students.

**Algebraic Geometry**
**Wednesday, January 30, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Brian Lehmann (Rice)**
*Big cycles and volume functions*

The volume of a divisor is an important invariant measuring the "positivity" of its numerical class. I will discuss an analogous construction for cycles of arbitrary codimension. In particular, this yields geometric characterizations of big cycle classes modeled on the well-known criteria for divisor and curve classes.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Topology**
**Thursday, January 31, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Priyam Patel (Rutgers)**
*Quantifying Residual Finiteness and LERF-ness in Terms of Geometric Data*

This talk will begin by defining residual finiteness (RF) and locally extended residual finiteness (LERF) for groups, followed by a brief history of the results that study the connection between these algebraic properties and the fundamental groups of surfaces and 3-manifolds. We will then describe what it means to quantify these group properties and present the results that quantify RF-ness and LERF-ness of hyperbolic surface groups in terms of geometric data. If time permits, we will conclude with an overview of similar techniques used to quantify residual finiteness for particular hyperbolic 3-manifold groups.

**Commutative Algebra**
**Thursday, January 31, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Daniel Erman (University of Michigan)**
*Laurent Polynomials and Eulerian Numbers*

Prompted by a question of Sturmfels, we show a surprising connection between the Eulerian numbers and Laurent polynomials whose powers have a zero constant term. We will discuss the proof, which involves multigraded commutative algebra and toric geometry, as well as several natural follow-up questions.

**Math Club**
**Thursday, January 31, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**David Speyer (Univ. of Michigan)**
*Unsolvability of the quintic equation*

As you may have heard, there is no formula to express the roots of a fifth degree polynomial in terms of its coefficients, using the operations of addition, subtraction, multiplication, division and n-th root extraction. By watching how the roots of the polynomial z^5 - z - t move in the complex plane as the parameter t varies, we will be able to see that no such formula exists

**Differential Equations**
**Thursday, January 31, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Moritz Reintjes (Univ. Regensburg)**
*Points of General Relativistic Shock Wave Interaction are "Regularity Singularities" where Spacetime is Not Locally Flat*

In this talk I am going to present the results of a recent paper, in which we show that the regularity of the gravitational metric tensor cannot be lifted from C^{0,1} to C^{1,1} by any C^{1,1} coordinate transformation in a neighborhood of a point of shock wave interaction in General Relativity, without forcing the determinant of the metric tensor to vanish at the point of interaction. This is in contrast to Israel's celebrated 1966 Theorem, which states that such coordinate transformations always exist in a neighborhood of a point on a smooth single shock surface. The results imply that points of shock wave interaction represent a new kind of singularity in spacetime, singularities that make perfectly good sense physically, that can form from the evolution of smooth initial data, but at which spacetime is not locally Minkowskian under any coordinate transformation. In particular, at such singularities, delta function sources in the second derivatives of the gravitational metric tensor exist in all coordinate systems, but due to cancelation, the Riemann curvature tensor remains uniformly bounded.

**Student Analysis**
**Thursday, January 31, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**Purvi Gupta (University of Michigan)**
*Deconstructing the Infinity Laplacian*

What is common between the optimal Lipschitz extension problem and a game of tug-of-war? One connection is via the infinity Laplacian --- a fully non-linear degenerate elliptic second-order partial differential operator that is obtained as a limit of 'generalized' Laplacians. In this talk, we will first describe the interpolation problem that motivated the study of this operator and then switch gears to see a game-theoretic interpretation of the associated Dirichlet problem. The talk will be elementary, and despite the topic, there will be very little PDE (we won't integrate by parts even once).

**Theoretical Computer Science**
**Friday, February 01, 2013, 10:00am-11:00am**
**411 West Hall**
**Atri Rudra (Buffalo)**
*One algorithm to rule them all: One join query at a time*

We present a recent algorithm (PODS 2012) that is the first provably optimal (worst-case) algorithm to compute database joins.

As a special case, we show that this join algorithm implies (i) The first algorithmic versions of some well-known geometric inequalities due to Loomis and Whitney (and their generalizations by Bollobas and Thomason); (ii) Algorithmically list recoverable codes that work with parameters that no known algorithmic list recovery result work with (e.g. those based on the Reed-Solomon codes) and an application of this result in designing sublinear time decodable compressed sensing schemes; (iii) Worst-case optimal algorithm to list all occurrences of any fixed hypergraph H in a given large hypergraph G.

We believe that this algorithm should find many more applications. (If time permits, I'll also mention some followup work on instance optimal join algorithms.)

This talk will focus on (i) and (ii) and is based on joint works with Gilbert, Ngo, Nguyen, Porat, Re and Strauss.

Bio: Atri Rudra is an Assistant Professor of Computer Science and Engineering at University at Buffalo, State University of New York, Buffalo. Atri received his Bachelor's degree from Indian Institute of Technology, Kharagpur, India in 2000 and his Ph.D. from University of Washington in 2007. From 2000-2002, he was a Research Staff Member at IBM India Research Lab, New Delhi, India.

His research interests lie in theoretical computer science and in particular, theory of error-correcting codes, data stream and sub-linear algorithms, database algorithms, computational complexity, finite field theory and applications. He is a recipient of an NSF CAREER award (2009), HP Labs Innovation Research Award (2010), ESA best paper award (2010), UB Exceptional Scholars - Young Investigator award (2011) and PODS best paper award (2012).

**Applied Interdisciplinary Mathematics**
**Friday, February 01, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Shravan Veerapaneni (University of Michigan)**
*A fast algorithm for spherical grid rotations and its application to singular quadrature*

We present a fast and accurate algorithm for evaluating singular integral operators on smooth surfaces that are globally parametrized by spherical coordinates. Problems of this type arise, for example, in simulating Stokes flows with particulate suspensions and in multi-particle scattering calculations. For smooth surfaces, spherical harmonic expansions are commonly used for geometry representation and the evaluation of the singular integrals is carried out with a spectrally accurate quadrature rule on a set of rotated spherical grids. We propose a new algorithm, nearly optimal in computational complexity, that interpolates function values on the rotated spherical grids via hybrid nonuniform Fast Fourier Transforms.

**Geometry**
**Friday, February 01, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Amie Wilkinson (University of Chicago)**
*Absolute continuity, exponents, and rigidity*

The geodesics in a compact surface of negative curvature display stability properties originating in the chaotic, hyperbolic nature of the geodesic flow on the associated unit tangent bundle. Considered as a foliation of this bundle, this collection of geodesics persists in a strong way when one perturbs of the Riemannian metric, or the geodesic flow generated by this metric, or even the time-one map of this flow: for any perturbed system there is a corresponding "shadow foliation" with one-dimensional smooth leaves that is homeomorphic to the original geodesic foliation. A counterpart to this foliation stability is a curious rigidity phenomenon that arises when one studies the disintegration of volume along the leaves of this perturbed shadow foliation. I will describe this phenomenon and its underlying causes. This is recent work with Artur Avila and Marcelo Viana.

**Kottwitz Seminar**
**Friday, February 01, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Charles Stibitz (UM)**
*Spectra and Cohomology Theories*

(Please note that for the remainder of the semester, the Kottwitz Seminar will meet on Fridays, 4-6pm, unless announced otherwise.)

Our goal will be to introduce the category of (CW) spectra and explain its role in stable homotopy theory. We will look at basic examples of spectra as well as some of the constructions that can be done on spectra. We will then look at the relation of spectra to generalized homology and cohomology theories.

**Combinatorics**
**Friday, February 01, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Andreas Blass (University of Michigan)**
*Shelah's bipartite matching algorithm*

I'll present an algorithm, due to Shelah, for deciding in choiceless polynomial time with counting whether a given bipartite graph admits a complete matching. I'll begin by describing what "choiceless polynomial time with counting" means, and then I'll describe two familiar bipartite matching algorithms that don't qualify: the path-augmenting algorithm isn't choiceless, and the marriage theorem isn't polynomial time. Both of these nevertheless play a role, along with some other ideas, in Shelah's result.

**Group, Lie and Number Theory**
**Monday, February 04, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Daniel Fiorilli (UM)**
*Unbounded ranks of elliptic curves, highly biased prime number races and the explicit formula*

In 1853, Chebyshev remarked that there are more primes of the form 4n+3 than of the form 4n+1 in the interval [1,x], for many values of x. Rubinstein and Sarnak established under technical hypotheses that the logarithmic density of x for which Chebyshev's assertion is true is of 0.9959.... They also studied an even more biased race, and showed that the density of x such that Li(x)>\pi(x) is of 0.99999973... Since their 1994 paper, many other densities have been computed and none of these numbers were found to exceed this last value. A natural question to ask is whether this is the highest value one will ever find, or if on the contrary there exists highly biased prime number races whose associated density can be arbitrarily close to 1. Our goal is to discuss recent results on highly biased prime number races in two contexts. We will first establish a conditional equivalence between the existence of highly biased elliptic curve races and the existence of elliptic curves of arbitrarily large analytic rank. We will then show that highly biased prime number races do exist in the context of primes in arithmetic progressions, and describe how to construct such races. Finally we will describe how to weaken the technical hypotheses which are omnipresent in these types of problems. The central object on which this theory is built is the explicit formula, and if time allows, we will describe the techniques used in the proofs, which involve ideas from probability theory and from the theory of almost periodic functions.

**Student Algebraic Geometry**
**Monday, February 04, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Xin Zhou (UM)**
*Asymptotic Schur decomposition of Veronese Syzygies*

A very gentle introduction to the problem Mihai and I try to solve in this joint paper.

**Student Geometry/Topology**
**Monday, February 04, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Tengren Zhang (UM)**
*A Gentle Introduction to Higher Teichmuller Theory*

In this talk, I will be motivating and introducing Higher Teichmuller Theory using an example-oriented approach. The main example we will focus on is the relationship between Teichmuller space and the deformation space of convex projective structures on surfaces. If time permits, I will show how other abstract definitions (e.g. Hyperconvexity, Anosovness) are generalizations of very concrete phenomena in the main example. No prior experience with Higher Teichmuller Theory required.

**Several Complex Variables**
**Monday, February 04, 2013, 4:00pm-5:00pm**
**3096 East Hall**
**Elizabeth Wulcan (U Gothenburg/Chalmers)**
*Green functions and Segre numbers*

This talk is based on a joint work with Mats Andersson and Pascal Thomas. We give meaning to (higher) Monge-Ampere masses (dd^c G)^k of Rashkovskii-Sigurdsson's Green function G with poles along an ideal sheaf I (also for k larger than the codimension of I). We show that the Lelong numbers of 1_Z (dd^c G)^k, where Z is the variety of I, are the so-called Segre numbers of I. This result generalizes the well-known fact that if Z is a point, the top Monge-Ampere mass is just a point mass with mass equal to the Hilbert-Samuel multiplicity of I.

**Geometry & Physics**
**Monday, February 04, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Zhengyu Zong (Columbia)**
*The two-leg orbifold Gromov-Witten vertex*

For toric Calabi-Yau 3-orbifolds, the orbifold GW theory is obtained by gluing the orbifold GW vertex, a generating function of cubic abelian Hurwitz-Hodge integrals. So the orbifold GW vertex can be viewed as the building block of the orbifold GW theory of toric Calabi-Yau 3-orbifolds. In this talk, I will give a formula of the 2-leg orbifold GW vertex. After computing the effective and gerby 1-leg orbifold GW vertex, the computation of the 2-leg orbifold GW vertex can be reduced to the 1-leg cases. I will also talk about the combinatorial aspects (in particular, the Gromov-Witten/Donaldson-Thomas correspondence) of both the 1-leg and 2-leg cases. This work is joint with Dustin Ross.

**Student Combinatorics Seminar**
**Monday, February 04, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Alex Leaf (UM)**
*The Seymour-Robertson Theorem and Graph Minor Theory*

In the 1930s, Klaus Wagner conjectured that in any infinite set of finite undirected graphs, there exist two graphs on the list such that one graph is isomorphic to a minor of the other. Neil Robertson and Paul Seymour proved Wagner's Conjecture (now the Seymour-Robertson Theorem) over the course of twenty papers published between 1983 and 2004. While the statement of this theorem may seem inconspicuous at first, the Seymour-Robertson Theorem, and its proof, have had a huge impact on graph theory. For example, this theorem guarantees the existence of a polynomial time algorithm for testing any minor-closed property of graphs, such as embeddability on a fixed closed, compact surface. In this talk, we will discuss some of the ideas behind the proof of this theorem, and some of its consequences. We will not assume any previous background in graph theory.

**Colloquium Series**
**Tuesday, February 05, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Joel Smoller (Univ of Michigan)**
*Gravitation*

Gravitation

Abstract: We discuss gravitation from Newton, to Einstein, to present-day.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Student Arithmetic**
**Wednesday, February 06, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Jake Levinson (UM)**
*Local fields and Galois representations*

The goal of this talk is to present some of the tools from Galois theory and class field theory used to study the absolute Galois group of Q and its representations, a key component of the Shimura-Taniyama conjecture. We'll mainly be comparing the structure of the absolute Galois group of the rationals to the Galois groups of local (or even finite) fields, which are much simpler to describe. We'll also give a complete description (from class field theory) of one-dimensional representations of these groups using the so-called cyclotomic character. Time permitting, we'll briefly touch on general Galois representations, especially two-dimensional l-adic reps, since these are the specific representations used in the modularity conjecture.

**Student Commutative Algebra**
**Wednesday, February 06, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Zhibek Kadyrsizova (UM)**
*Tight closure of ideals*

We will define the notion of  tight closure of ideals in Noetherian rings of prime characteristic p>0 and prove properties of tight closure some of which will allow us to reduce to the case of reduced rings or domains. In addition, we will show that regular rings are weakly F-regular.

**Student AIM Seminar**
**Wednesday, February 06, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**()**
*No Talk. Reminder: SIAM Student Conference This Saturday, Feb 9, 1360 EH, 10:00am*

**Algebraic Geometry**
**Wednesday, February 06, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Daniel Erman (UM)**
*Semiample Bertini theorems over finite fields*

For a smooth projective variety over a finite field, Poonenâ€™s Bertini Theorem computes the probability that a high degree hypersurface section of that variety will be smooth.  We prove a semiample generalization of Poonen's result.  This is joint with Melanie Matchett Wood.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Analysis/Probability**
**Wednesday, February 06, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Alexander Powell (Vanderbilt University)**
*Consistent reconstruction and some geometry of random polytopes*

Consistent reconstruction is a linear programming approach for estimation problems involving bounded noise (for example, the problem of reconstructing a signal from a set of quantized linear measurements). We prove new mean squared error bounds for consistent reconstruction in the setting of random frames and under the uniform quantization noise model. In particular, we prove that the mean squared error for consistent reconstruction is of the optimal order C/N^2 where N is the number of measurements, and we prove bounds on the associated dimension dependent constant C. For comparison, in the case of unit-norm tight frames with linear reconstruction (instead of consistent reconstruction) the mean squared error only satisfies a weaker bound of order 1/N. Our main results involve an analysis of random polytopes and of associated coverage processes on the sphere. This is joint work with Tyler Whitehouse.

**Commutative Algebra**
**Thursday, February 07, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Luis Nunez-Betancourt (University of Michigan)**
*Associated primes of local cohomology of flat extensions with regular fibers*

In this talk, we will discuss the following question raised by Mel Hochster: let $(R,m,K)$ be a local ring and $S$ be a flat extension with regular closed fiber. Is the set of associated primes of $H^i_I(S)$ that contain $mS$ finite for every ideal $I\subset S$ and every $i\in \mathbb{N}$? We will explore, using several tools from homological algebra, cases in which the answer is positive.

**Math Club**
**Thursday, February 07, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Jinho Baik (Univ. of Michigan)**
*Longest Monotone Subsequences*

A so-called ``well known theorem'' states that in any permutation of {1, 2,..., n^2+1}, there exists a monotone subsequence of length at least n+1, either increasing or decreasing. In 1961 Stan Ulam raised the problem of determining the distribution of the longest increasing subsequence of a random permutation. In 1972 Hammersley wrote a fascinating essay on this problem: "A few seedlings of research." We discuss this problem and research it led to in probability and statistical physics.

**Analysis/Probability Learning Seminar**
**Thursday, February 07, 2013, 4:10pm-5:20pm**
**4096 East Hall**
**Alexander Powell (Vanderbilt University)**
*Consist reconstruction and some geometry of random polytopes*

This is a more technical continuation of Wednesday's Analysis/Probability seminar.

Consistent reconstruction is a linear programming approach for estimation problems involving bounded noise (for example, the problem of reconstructing a signal from a set of quantized linear measurements). We prove new mean squared error bounds for consistent reconstruction in the setting of random frames and under the uniform quantization noise model. In particular, we prove that the mean squared error for consistent reconstruction is of the optimal order C/N^2 where N is the number of measurements, and we prove bounds on the associated dimension dependent constant C. For comparison, in the case of unit-norm tight frames with linear reconstruction (instead of consistent reconstruction) the mean squared error only satisfies a weaker bound of order 1/N. Our main results involve an analysis of random polytopes and of associated coverage processes on the sphere. This is joint work with Tyler Whitehouse.

**Student Analysis**
**Thursday, February 07, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**Derek Wood (University of Michigan)**
*Strichartz Estimates*

Strichartz estimates are powerful tools used in the study of dispersive partial differential equations. They were initially obtained by R. Strichartz using Fourier restriction theorems and a duality argument. They have since been generalized and used extensively. Our focus will be on the Strichartz estimates for the wave equation. We will outline their proof, and apply them to prove a small data global existence result.

**Theoretical Computer Science**
**Friday, February 08, 2013, 10:00am-11:00am**
**411 West Hall**
**Qi Cheng (University of Oklahoma)**
*On the Decodability of Primitive Reed-Solomon Codes*

Reed-Solomon codes are (list-)decodable up to the Johnson-Guruswami-Sudan bound. No polynomial time decoding algorithm is known when number of errors is larger than the JGS bound. The maximum likely-hood decoding of generalized Reed-Solomon codes is NP-hard, but it appears hard to establish complexity results for the primitive Reed-Solomon codes. In this talk, I will present several results on this problem. I will also talk about the deterministic construction of small Hamming balls containing many Reed-Solomon codewords.

**Applied Interdisciplinary Mathematics**
**Friday, February 08, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Pej Rohani (Ecology and Evolutionary Biology, University of Michigan)**
*Unmasking the interaction between influenza and bacterial pneumonia*

Polymicrobial infections, whereby transmission and pathogenicity of one agent are affected by interactions with others, are increasingly recognized. An important putative manifestation of this phenomenon involves pneumococcus bacteria and their role during influenza pandemics and seasonal epidemics. While experiments in animal models have unequivocally demonstrated presence of influenza-pneumococcus interaction, epidemiological support for an association in humans remains unclear. In this talk, I will describe how using high-resolution case reports, a mechanistic transmission model, and a likelihood-based inference framework, we have characterized the nature, timing and magnitude of the interaction. We find support for a strong but short-lived interaction, with influenza infection increasing susceptibility to pneumococcal pneumonia ~100-fold. Given the nature and the timescale of the interaction, the ability to detect any association from epidemiological data may depend on the variability in the magnitude of influenza outbreaks. Further, I will explain the implications of these results by studying a within-host model of pathogenesis, characterized as coupled delay differential equations.

**Kottwitz Seminar**
**Friday, February 08, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Charles Stibitz (UM)**
*Spectra and Cohomology Theories, part 2*

In this talk we will look at the relationship between spectra and (co)homology theories. In particular we will show how to take a spectrum and produce a cohomology theory. We will then prove Brown's representability theorem which allows one to construct a spectrum from a cohomology theory. Last we will introduce the Atiyah-Hirzebruch spectal sequence and discuss its relation to this story.

**Combinatorics**
**Friday, February 08, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Michael Shapiro (Michigan State University)**
*Growth rate classification for cluster algebras*

The growth rate function of a cluster algebra counts the number of cluster variables that can be obtained from the initial cluster in a given number of steps. We classify cluster algebras according to whether their growth rate is bounded, polynomial, or exponential. In particular, we show that all exceptional non-affine mutation-finite cluster algebras have exponential growth.

This is joint work with A. Felikson, H. Thomas, and P. Tumarkin.

**Mathematical Biology**
**Monday, February 11, 2013, 12:00pm-1:00pm**
**335 West Hall**
**Allen Liu (Dept of Mechanical Engineering, University of Michigan)**
*Systems analysis of clathrin-coated pit dynamics*

**Group, Lie and Number Theory**
**Monday, February 11, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**AVAILABLE ()**
*TBA*

**Student Algebraic Geometry**
**Monday, February 11, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Nic Ford (UM)**
*Positroid varieties and Schubert calculus*

Take a bunch of vectors in a vector space, and impose some linear conditions on them --- for example, say that vectors 1, 3, 5, and 6 need to span a subspace of dimension 2, and that vectors 2 and 4 have to be parallel. When the conditions are all on left- or right-justified collections of vectors, the study of these arrangements is called Schubert calculus. In general, imposing these linear conditions specifies some subvariety of the Grassmannian, and computing its cohomology class will help us solve enumerative problems of this type. This talk will be about some of the progress that's been made in this direction, and some half-baked ideas for extending it further.

**Student Geometry/Topology**
**Monday, February 11, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Andrew Zimmer (UM)**
*Random walks on discrete subgroups of Lie groups*

In this talk we will discuss random walks on discrete groups. The first half of the talk will be devoted to basic examples and terminology. In the second half of the talk we will specialize to discrete subgroups of Lie groups. It turns out that knowing properties of the ambient Lie group says a lot about the statistics of random walks on the discrete subgroup and understanding random walks on the discrete subgroup can tell you information about the ambient Lie group. I will mainly focus on the special linear group so the talk should be very accessible.

**Geometry & Physics**
**Monday, February 11, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Todor Milanov (IPMU)**
*The local Eynard-Orantin recursion in Gromov--Witten theory*

The Eynard--Orantin recursion was discovered first in the settings of matrix models. It turns out that the recursion holds in Gromov--Witten theory as well, which in particular provides a very powerful tool for computing Gromov--Witten invariants for manifolds whose quantum cohomology is semi-simple. My plan is first to introduce the recursion and then using Givental's higher genus reconstruction to explain how one can prove the relations via the well known Virasoro constraints for the intersection numbers of the Delign--Mumford moduli space of curves.

**Student Combinatorics Seminar**
**Monday, February 11, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Charlotte Chan (UM)**
*Chevalley's Theorems: Representations of Lie Groups and Invariants of Finite Groups*

Our main goal will be to discuss two of Chevalley's major theorems, bringing together ideas from representation theory, commutative algebra, algebraic geometry, and combinatorics. The first theorem relates the ring of class functions of a Lie group to the ring of functions on a maximal torus invariant under the action of the Weyl group. As one way to try to understand the representations of a Lie group is to understand the space in which characters live, it is then natural to ask (by way of Chevalley's first theorem) what the structure of the Weyl-invariant functions on a maximal torus is. Chevalley's second theorem gives a beautiful answer to this result: it is a polynomial ring!

For commutative algebraists: Let R be the polynomial ring of n indeterminates with complex coefficients and let G be a finite subgroup of GLn(C). The ring of indeterminates R^G is a Cohen-Macaulay ring. But when is R^G a polynomial ring? Equivalently, for algebraic geometers: When is the quotient variety C^n/G = A^m? There is a clean classification to such groups. In this discussion, we will also see the appearance of the regular representation of G, tying our discussion back to representation theory.

**Colloquium Series**
**Tuesday, February 12, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Ilya Kapovich (University of Illinois at Urbana-Champaign)**
*(cancelled due to medical reason).*

**Student Arithmetic**
**Wednesday, February 13, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Ari Shnidman (UM)**
*Galois representations and their deformations*

I hope to give an introduction to Mazur's method of deforming Galois representations and to explain how it is used in Wiles' proof of the modularity conjecture for semistable elliptic curves.

**Student AIM Seminar**
**Wednesday, February 13, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Andre Souza (University of Michigan)**
*Boussinesq Convection*

The Boussinesq equations have long served as a model for understanding turbulent heat transport. In this talk the motivation behind the equations as well as some recent results with regards to the asymptotic scaling of heat transport will be discussed. Some numerical methods for computing stationary solutions to the equations will also be mentioned. This talk should be accessible to all math graduate students.

**Algebraic Geometry**
**Wednesday, February 13, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Sam Payne (Yale)**
*Tropicalization of the moduli space of curves*

Tropical geometry allows a systematic study of algebraic curves over valued fields in terms of the marked dual graphs of special fibers of models of the curve over the valuation ring. In the past several years, a number of researchers, including Caporaso, Gathmann, Kozlov, Mikhalkin, and their collaborators, have introduced and studied moduli spaces for these marked graphs, which are often called tropical curves, and estabilshed various analogies to moduli spaces of curves. I will present work that explains and extends these analogies, canonically and functorially, by applying a new generalized tropicalization map for toroidal Deligne-Mumford stacks to the moduli space of stable curves. Berkovich spaces appear in the construction of this new tropicalization map in a natural and elementary way, but no tropical or nonarchimedean analytic background is assumed. This is joint work with D. Abramovich and L. Caporaso.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Commutative Algebra**
**Thursday, February 14, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Mathias Lederer (UniversitÃ¤t Bielefeld)**
*Geometric Littlewood-Richardson rules*

The ring of symmetric functions is the cohomology ring of Grassmannians. The Schur functions $s_\lambda$ are a $\mathbb{Z}$-basis of it. These functions are indexed by partitions $\lambda$; the multiplicative structure of the ring is given by the Littlewood-Richardson coefficients appearing in $s_\lambda s_\mu = \sum c_{\lambda \mu}^\nu s_nu$. Vakil found a geometric way of determining the Littlewood-Richardson coefficients. Knutson generalized his method, thus also determining equivariant cohomology and $K$-theory of Grassmannians. We will study a deformation of the ring of symmetric functions which naturally appears in equivariant homology of Grassmannians. We will discuss a $\mathbb{Z}[t]$-basis of it, and sketch the way toward a Littlewood-Richardson rule for determining the ring structure. (Joint work with Allen Knutson.)

**Math Club**
**Thursday, February 14, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Alexander Duncan (Univ. of Michigan)**
*Undecidable Problems*

Informally, a problem is undecidable if is impossible to write a computer program to solve it. Many surprisingly elementary questions in mathematics turn out to be undecidable. I will outline how we know such problems exist and give several examples from different branches of mathematics.

**Analysis/Probability Learning Seminar**
**Thursday, February 14, 2013, 4:10pm-6:00pm**
**4096 East Hall**
**Elena Yudovina (University of Michigan)**
*The scaling of the Hardy-Littlewood maximal inequality with dimension*

The Hardy-Littlewood maximal function is an important tool in real and harmonic analysis. We will try to understand how the volume of the points where the maximal function is large scales with dimension. A long-standing question has been to determine whether there is a dimension-independent upper bound. In a recent breakthrough, the scaling was completely characterized for the maximal function associated to the cube. One half of the breakthrough (which we will not discuss now) is a two-month-old paper of Bourgain. We will present the other half, following the argument of Aubrun. Although the question comes from analysis, the construction will use probabilistic ideas and Brownian motion.

**Student Analysis**
**Thursday, February 14, 2013, 5:10pm-6:00pm**
**3096 East Hall**
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*No Talk*

**Theoretical Computer Science**
**Friday, February 15, 2013, 10:30am-11:30am**
**3941 BBB/CSE**
**Steve Lu ()**
*Distributed Oblivious RAM for Secure Two-Party Computation*

We present a new method for secure two-party Random Access Memory (RAM) program computation that does not require taking a program and first turning it into a circuit. The method achieves logarithmic overhead compared to an insecure program execution.

At the heart of our construction is a new Oblivious RAM protocol where a client interacts with two non-communicating servers. Our two-server Oblivious RAM for n reads/writes requires O(n) memory for the servers, O(1) memory for the client, and O(log n) amortized read/write overhead for data access. In our two-server model, we describe a new technique to bypass oblivious sorting which results in tiny constants and leads to a more practical Oblivious RAM protocol that compares favorably to the state-of-the-art single-server schemes.

Our two-server Oblivious RAM protocol leads to a novel application in the realm of secure two-party RAM program computation. We show that our Oblivious RAM construction can be composed with an extended version of the Ostrovsky-Shoup compiler to obtain a new method for secure two-party program computation with lower overhead than all existing constructions.

Joint work with Rafail Ostrovsky.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Applied Interdisciplinary Mathematics**
**Friday, February 15, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Deniz Akcabay (Naval Architecture and Marine Engineering, University of Michigan)**
*Cantilever beams in axial flows: flutter Instabilities, post-critical dynamics, scaling laws, and energy harvesting applications*

Structures may lose their stability if exposed to external flows; a very famous example of this is the collapsed Tacoma Narrows Bridge in 1940. Accordingly, proper designs should ensure the stability of exposed structures to avoid failure or permanent deformations. However, there are many cases where flow exerted deformations on solids might be desired. Examples include energy harvesting applications where the fluid induced deformations might be converted to electricity through electroactive polymers (EAP), as well as the use of flexible lift-generating surfaces, such as propeller blades, hydrofoils, that might perform better in off-design operating conditions than their rigid counterparts.
The first part of this talk presents the current results of our studies on the dynamics of two-dimensional cantilevered beams in incompressible, viscous fluid flows. The solution method involves solving the Navier-Stokes equations for the fluid using a fractional-step method and the Kirchhoff-Love equations for the beam and coupling the fluid and solid dynamics with Peskin's Immersed Boundary method. The results include identifying the critical non- dimensional parameters, identifying the flutter stability boundary, and classifying the different vorticity shedding patterns and beam oscillation modes as a function of these critical parameters. The second part of this talk focuses on piezoelectric cantilever beams and their use to harvesting energy under flutter conditions. The electromechanical coupling brings on two additional critical parameters in terms of a non-dimensional energy conversion and electric damping coefficient. The talk will conclude on assessing the feasibility of applying two-different scaling laws onto this system: the Reynolds number (Re) and Mach number (Ma) scale. It will be shown that designing reduced-scale experiments with Re scaling brings various difficulties (impossibilities) mostly due to material selection issues, while the Ma scaling is very favorable for moderate to high Re operating conditions. This is a joint work with Prof. Yin Lu Young.

**Kottwitz Seminar**
**Friday, February 15, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Charles Stibitz (UM)**
*Spectra and Cohomology Theories, part 3*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Group, Lie and Number Theory**
**Monday, February 18, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Bianca Viray (Brown University)**
*Reductions of CM j-invariants modulo p*

The moduli space of elliptic curves contains infinitely many algebraic points that correspond to curves with complex multiplication. In 1985, Gross and Zagier proved that the pp-adic valuation of the difference of two CM j- invariants is exactly half the sum (over n) of the number of isomorphisms between the corresponding elliptic curves modulo pp^n. Using this relation, Gross and Zagier proved an elegant formula for the factorization of the norm of a difference of CM j-invariants, assuming that the CM orders are maximal and have relatively prime discriminants. We generalize their result to the case where one order has squarefree discriminant and the other order is arbitrary. If time permits, we will explain how this result can be used to answer a similar question in genus 2. This is joint work with Kristin Lauter.

**Student Algebraic Geometry**
**Monday, February 18, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Felipe Perez (UM)**
*The Briancon-Skoda Theorem*

The Briancon-Skoda Theorem gives bounds on how large the integral closure of powers of an ideal can be. In this talk we give a proof of this theorem that involves multiplier ideals.

**Student Geometry/Topology**
**Monday, February 18, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Andrew Schaug (UM)**
*An outline of basic Hodge theory*

A brief overview of KÃ¤hler manifolds, Dolbeaut cohomology and Hodge's theorem of harmonic forms.

**Geometry & Physics**
**Monday, February 18, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Yongbin Ruan (UM)**
*Gromov-Witten theory of quotient of quintic 3-fold*

**Several Complex Variables**
**Monday, February 18, 2013, 4:00pm-5:00pm**
**3096 East Hall**
**Alexander Izzo (Bowling Green State / UM)**
*Generators for Algebras Dense in L^p spaces*

For various L^p-spaces (1\leq p<\infty) we investigate the minimum number of complex-valued functions needed to generate an algebra dense in the space. The results depend crucially on the regularity imposed on the generators. For \mu a positive regular Borel measure on a compact metric space there always exists a single bounded measurable function that generates an algebra dense in L^p(\mu). However, the situation is very different when the generators are required to be continuous or smooth. The most interesting case turns out to be that of continuous generators. This is joint work with Bo Li.

**Student Combinatorics Seminar**
**Monday, February 18, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Robert Walker (UM)**
*An Evening with Lagrange Inversion and Interpolation*

Often enough, math talks communicate results that, while charming in a fleeting moment, will not amount to a "Chekhov's gun" in terms of being used at any stage of one's active research. By contrast, the goal of this talk is to emphasize--through both standard and nonstandard examples in combinatorics--how, and roughly when, the techniques of Lagrange Inversion and Interpolation can be used to tackle research problems.

**What is... ?**
**Tuesday, February 19, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**Joseph Silverman (Brown University)**
*A whirlwind survey of the arithmetic of elliptic curves*

In this talk I will discuss elliptic curves, starting with their topology, geometry (both analytic and algebraic), and etymology, and proceeding to their number theoretic properties, including their group of rational points, set of integral points, points over finite fields, and L-series, with a brief mention of applications ranging from cryptography to Fermat's Last Theorem. There will be no proofs, but at the conclusion I hope to have provided you with a panorama of this beautiful subject.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Colloquium Series**
**Tuesday, February 19, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Joe Silverman (Brown University)**
*The dynamical complexity of rational maps and an arithmetic analogue*

Consider a rational map F = (F_1,...,F_N) consisting of an N-tuple of rational functions in N variables. The iterates F, F^2, F^3, ... of F determine a dynamical system whose complexity may be measured by the growth of the degree of F^n. A fundamental, and still quite mysterious, invariant is the dynamical degree D(F) of F, which is defined to be the limiting value of deg(F^n)^{1/n} as n goes to infinity. Recently people have also considered an arithmetic analogue of the dynamical degree in which one looks at the orbit of a point P having rational coordinates and replaces deg(F^n) by the arithmetic size of the coordinates of F^n(P). In this talk I will discuss dynamical degrees, arithmetic degrees, and various results and open problems that relate them. No background in dynamics, algebraic geometry, or number theory will be required.

**Student Arithmetic**
**Wednesday, February 20, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Gene Kopp (UM)**
*Zagier's Magic Formulas for Real Quadratic Fields*

If $K$ is an imaginary quadratic field, the zeta function $\zeta_K(s,A)$ of an ideal class $A$ of $\mathcal{O}_K$ is essentially a real analytic Eisenstein series. Instead let $K$ be real quadratic; this is no longer the case. However, an elementary trick due to Hecke expresses $\zeta_K(s,A)$ as the integral of real analytic Eisenstein series over a geodesic in the upper half plane. We will discuss (and sketch the proof of) some mind-blowing formulas of Meyer and Zagier relating the constant term of $\zeta_K(s,A)$ at $s=1$ to the periods of continued fractions. Connections will be drawn to the Stark conjectures and Hilbert's Twelfth Problem.

**Student Commutative Algebra**
**Wednesday, February 20, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Patricia Klein (UM)**
*Algebraic Statistics*

We will discuss several statistical problems that arise naturally from the study of phylogenetics and sequence alignment and see how these questions can be naturally packaged as questions about polynomial rings. We will then see in broad strokes how techniques in computational commutative algebra can answer these questions (relatively) efficiently.

**Student AIM Seminar**
**Wednesday, February 20, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Olivia Walch (University of Michigan)**
*Critical Exponents*

Let $\mathcal{P}$ be a class of matrices, and let $A$ be an $m$-by-$n$ matrix in the class; consider some continuous powering, $A^{\{t\}}$. The critical exponent of $\mathcal{P}$, if it exists, with respect to the powering is the lowest power $g(\mathcal{P})$ such that for any matrix $B \in \mathcal{P}$ , $B^{\{t\}} \in \mathcal{P} \ \forall \ t > g(\mathcal{P})$. For powering relative to matrix multiplication in the traditional sense, hereafter referred to as \emph{conventional} multiplication, this means that $A^t$ is in the specified class for all $t > g_C(\mathcal{P})$. For Hadamard multiplication, similarly, $A^{(t)}$ is in the class $\forall \ t > g_H(\mathcal{P})$. We consider two questions for several classes $\mathcal{P}$ (including doubly nonnegative and totally positive): 1) does a critical exponent $g(\mathcal{P})$ exist? and 2) if so, what is it? For those where no exact result has been determined, lower and upper bounds are provided.

**Algebraic Geometry**
**Wednesday, February 20, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Gabi Farkas (Berlin)**
*Syzygies of torsion bundles and the geometry of the level l modular variety over M_g*

In joint work with Chiodo, Eisenbud and Schreyer, we formulate, and in some cases prove, three statements concerning the purity of the resolution of various rings one can attach to a generic curve of genus g and a torsion point of order l in its Jacobian. These statements can be viewed as analogues of Green's Conjecture and we verify them computationally for bounded genus. We then compute the cohomology class of the corresponding non-vanishing locus in the moduli space R_{g,l} of twisted level l curves of genus g and use this to derive results about the birational geometry of R_{g, l}. For instance, we prove that R_{g,3} is a variety of general type when g>11. I will also discuss the surprising failure of the Prym-Green Conjecture for genera which are powers of 2.

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, February 20, 2013, 4:00pm-6:00pm**
**3096 East Hall**
**Ralf Spatzier (U Michigan)**
*On automorphisms of convex cones I (after Benoist)*

I will discuss a paper of Benoist of automorphisms of convex cones. This give highly interesting examples of discrete groups in GL(n,R).

**Commutative Algebra**
**Thursday, February 21, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Morgan Brown (University of Michigan)**
*Finite generation in characteristic $0$ and characteristic $p$*

One of the fundamental problems in birational geometry is to determine whether or not finite generation holds for the ring of sections $R(X,D)$ of a divisor $D$ on a variety $X$. We will start by considering a specific case: Let $I$ be the ideal of a monomial curve in $k[x,y,z]$, and let $R$ be the symbolic Rees algebra. In general it is not known when these are finitely generated, but there are examples due to Goto, Nishida, and Watanabe, which are not finitely generated when $k$ has characteristic $0$ but are when $k$ has positive characteristic.

**Differential Equations**
**Thursday, February 21, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Kevin Zumbrun (Indiana U. )**
*CONVEX ENTROPY, HOPF BIFURCATION, AND VISCOUS AND INVISCID SHOCK STABILITY*

We discuss relations between one-dimensional inviscid and viscous stability/bifurcation of shock waves in continuum-mechanical systems and existence of a convex entropy. In particular, we show that the equations of gas dynamics admit equations of state satisfying all of the usual assumptions of an ideal gas, along with thermodynamic stability- i.e., existence of a convex entropy- yet for which there occur unstable inviscid shock waves. For general 3x3 systems (but not up to now gas dynamics), we give numerical evidence showing that viscous shocks can exhibit Hopf bifurcation to pulsating shock solutions. Our analysis of inviscid stability in part builds on the analysis of R. Smith characterizing uniqueness of gas dynamical Riemann solutions in terms of the equation of state of the gas, giving an analogous criterion for stability of individual shocks.

**Math Club**
**Thursday, February 21, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Mark Conger (Univ. of Michigan)**
*Mathematics of Card Shuffling*

How many times should you shuffle a deck of cards to mix the cards? In 1992 Dave Bayer and Persi Diaconis wrote an influential paper on the problem. The news media reported that their answer was "seven." This talk will explain the mathematics behind their result, and will also describe generalizations of it.

**Analysis/Probability Learning Seminar**
**Thursday, February 21, 2013, 4:10pm-6:00pm**
**4096 East Hall**
**Fedor Nazarov (Kent State University)**
*Estimates for the number of real zeroes of random polynomials*

Consider a random polynomial P(x) of degree n>1 with independent symmetrically distributed i.i.d. real coefficients. We will show that the average number of its real zeroes does not exceed C log n where C is an absolute constant.

**Student Analysis**
**Thursday, February 21, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**Rafe Kinsey (University of Michigan)**
*How to Prove Existence of Nonlinear PDE*

My talk will be a relatively elementary introduction to basic concepts in nonlinear (time-dependent) PDE. I'll discuss the basic paradigm we use to prove local-in-time well-posedness: we prove an "a priori" inequality (often called an "energy inequality") and then we use it to prove existence of solutions for a short period of time. These proofs often involve taking tools from the machinery of functional analysis (things like contraction mappings, Banach-Alaoglu, etc.). I'm going to discuss this basic conceptual setup, with a few simple examples, and then survey different specific approaches to proving local existence. Time permitting, I'll then say a few words about global existence.

The talk should be accessible to people without much PDE background. (But, for those with more PDE background, I'll try to include some more subtle issues about the delicacies of proving well-posedness in more difficult cases.)

**Applied Interdisciplinary Mathematics**
**Friday, February 22, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Jun Zhang (Psychology, University of Michigan)**
*Topological characterization of interval and semi-orders*

The concept of semi-order was introduced by Luce (1956) to capture the intransitive indifference relation prevalent in social and behavioral sciences. Its numerical representation manifests a threshold structure (Scott-Suppes representation) characteristic of comparative judgments in psychophysics. Later, it became known that semi-order (and its fixed-threshold representation) was a special case of the more general interval order (and its interval graph representation) as succinctly characterized by Fishburn. In this talk, we first show how interval order induces a "nesting" relation, a partial order itself. A set with a semi-order on it is then precisely an interval-ordered set that does not contain any nesting among its elements. When nesting occurs, an interval-ordered set has two lexicographic orders, which agree on the subset of elements that do not nest one-another. Next, we investigate topologies on interval-order sets, and construct a topology (based on the notion of upper- and lower-holdings) that allows us to relate topological axiomatic separations to order relations. Specifically, under our proposed topology, two distinct elements are (i) nested iff they are T0 but not T1 separated; (ii) indifferent but non-nested iff they are T1 but not T2 separated; (iii) comparable iff they are T2 separated. Therefore, we achieve topological characterization of pairwise relations of all points in an interval-order set in terms of their topological separability.

(Work done with student collaborator Yitong Sun)

**Financial/Actuarial Mathematics**
**Friday, February 22, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Pierre Patie (Cornell University)**
*Fluctuation theory for completely asymmetric Markov processes*

We study the class of completely asymmetric standard processes living on an interval of the real line, that is for strong Markov processes having jumps only in one direction. This class of processes, which are a natural generalization of one dimensional-diffusions, arises naturally in risk theory. It also encompasses many interesting instances such as branching processes with immigration, spectrally negative LÃ©vy processesâ€¦ Under mild conditions, we present two original methodologies for characterizing the Laplace transform of their first exit times from an interval. We also discuss several potential theoretic properties and provide an expression of their resolvent densities. Finally, we illustrate our techniques by easily recovering the well-known fluctuation identities of spectrally negative LÃ©vy processes. The talk is based on joint work with Vincent Vigon (IRMA, Strasbourg, France)

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Combinatorics**
**Friday, February 22, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Li Li (Oakland University)**
*Positivity and tameness in rank 2 cluster algebras*

A lot of recent activity in the theory of cluster algebras has been directed towards various constructions of "natural" bases. In a joint work with A.Zelevinsky and K.Lee we construct a new basis in any rank 2 cluster algebra following an approach developed by P.Sherman and A.Zelevinsky. This basis consists of a special family of indecomposable positive elements that we called greedy elements. Inspired by the work of K.Lee, R.Schiffler and D.Rupel, we give an explicit combinatorial description for the greedy elements using the language of Dyck paths. Furthermore, we show that the indecomposable positive elements form a basis if and only if the cluster algebra is tame (that is, of finite or affine type).

**Group, Lie and Number Theory**
**Monday, February 25, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Jeffrey Lagarias (UM)**
*Addition versus Multiplication*

A fundamental theme in mathematics is the interaction of addition and multiplication. This talk gives some examples of such interaction from logic and complexity theory, group theory, lie theory, and number theory.

**Student Algebraic Geometry**
**Monday, February 25, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**David Stapleton (UM)**
*Introduction to Toric Variety Invariants from Algebraic Topology*

The explicit, hands-on, combinatorial nature of a toric variety makes it possible to access some of its topological invariants. In this talk we will introduce toric varieties and compute their fundamental groups and euler characteristics from the information in their fans. For example, we will exhibit a complex algebraic variety which has torsion fundamental group.

**Student Geometry/Topology**
**Monday, February 25, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Russell Ricks (UM)**
*Patterson-Sullivan Theory*

Patterson-Sullivan measures provide a way to use measure theory to study the geometry of nonpositively curved manifolds. We will introduce Patterson-Sullivan measures and discuss some of the basic concepts from ergodic theory that allow us to obtain results about geometry. The talk is intended to emphasize ideas and be accessible at a very basic level.

**Geometry & Physics**
**Monday, February 25, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Huai-Liang Chang (HKUST)**
*On algebraic geometric construction of enumerative invariants*

For the first half of the talk we explain Li-Tian/Behrend-Fantechi's algebraic construction of virtual cycle in Gromov Witten theory, and its comparison with symplectic construction. For the second half of the talk we discuss its analogue in Landau-Ginzburg type theory, which uses Kiem-Li's cosection localization. As examples we discuss the KP4 case(Guffin-Sharpe) and the C^n case (Fan-Jarvis-Ruan).

**Student Combinatorics Seminar**
**Monday, February 25, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Michael Chmutov (UM)**
*Combinatorial Hopf Algebras*

The talk is an introduction to combinatorial Hopf algebras. We will review the definition of a Hopf algebra and a few basic facts, and follow with some important examples of combinatorial Hopf algebras. Finally we will look in some more detail at the algebra of symmetric functions and the place it occupies in Zelevinski's theory of positive self-dual Hopf algebras.

**Teaching Mathematics**
**Monday, February 25, 2013, 5:15pm-6:30pm**
**3096 East Hall**
**Michael Von Korff (Reasoning Mind)**
*Mathematical Knowledge for Online Instruction*

Reasoning Mind is a Houston-based nonprofit that develops K-12 math learning software. In this talk, I will discuss the means by which we simulate expert teaching in a virtual classroom. To develop our online curriculum, we work with a team of expert math teachers who have offered us access to their knowledge of curriculum and mathematical pedagogy. I will outline our methods for modeling these teachers and discuss what we've learned about their knowledge and practices. Finally, I will describe some of the expertise we have gained that we could not have learned from classroom teachers--pedagogical knowledge that is unique to e-learning.<br />

**Colloquium Series**
**Tuesday, February 26, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Guillaume Bal (Columbia University)**
*Equations with random coefficients and theories of random fluctuations.*

Problems with small scale structures abound in applied sciences. Their detailed microscopic description is often not available or generates computationally intractable problems. Homogenization theory has then been developed to understand the influence of micro-structures at a macroscopic level. The assumptions on the micro-structure under which homogenization holds, such as, e.g., periodicity, quasi-periodicity, or stationarity and ergodicity, are often not satisfied in practice. However, the homogenization point of view proves to be very fruitful in, e.g., macroscopic parameter estimations and to assess how multi-scale algorithms fare in well-controlled settings.
Equally important in practice, but often much difficult to study, is the analysis of random fluctuations beyond the homogenization limit. These fluctuations model noise in parameter estimation measurements, which limits the reconstruction resolution. In this talk, I will review several recent results obtained on the random fluctuations of solutions of partial differential equations with random coefficients. We then analyze conditions under which multiscale algorithms correctly capture such random fluctuations.

**Student Arithmetic**
**Wednesday, February 27, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Brandon Carter (UM)**
*The Herbrand-Ribet Theorem*

Kummer proved that Fermat's Last Theorem holds for so-called regular primes and introduced "Kummer's Criterion": a prime $p$ is irregular if and only if $p$ divides the numerator of some Bernoulli number $B_{2k}$ with $2 < 2k < p - 1$. In 1932, Herbrand showed that if the Galois group of $\mathbb{Q}(\zeta_p)/\mathbb{Q}$ acts on a subgroup of order $p$ in the ideal class group in a prescribed fashion, then $p$ divides a specific Bernoulli number. Nearly 45 years later, Ribet was able to prove the converse to Herbrand's theorem, using Eisenstein series, modular forms, the Eichler-Shimura relation, and Galois representations to explicitly construct an unramified cyclic extension of degree $p$ over $\mathbb{Q}(\zeta_p)$ with the desired behavior.

In this talk we will discuss the relationships established between these tools and sketch Ribet's proof, with some difficulties black-boxed. As time permits, we will discuss connections to Vandiver's conjecture.

**Student Commutative Algebra**
**Wednesday, February 27, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Luis Nunez-Betancourt (UM)**
*The Hilbert-Kunz multiplicity*

We will introduce the Hilbert-Kunz multiplicity; as well, as give the prove that it is well defined. In addition, we will give properties of this multiplicity, including interactions with tight closure.

**Student AIM Seminar**
**Wednesday, February 27, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Yee Chee See (University of Michigan)**
*Turbulent Combustion Modeling*

Numerical simulation is an invaluable tool in the development of cleaner combustion technology as it can provide full characterization of the flow field inside an engine.
However, obtaining an accurate numerical prediction of the combustion process inside an engine can be difficult. This is because the process is inherently multi-physics in nature and usually occurs in a turbulent flow.
To fully resolve these effects in a realistic engine is computationally prohibitive so they are generally accounted for in simulation using turbulent combustion model. The models that are currently being used in practice span a wide range of fidelity.
Nevertheless, most models seek to reduce the complexity of chemistry while capturing the interaction between chemistry and turbulence. In this talk, I will present several turbulent combustion models and their assumptions. Only rudimentary understanding of flow physics and chemistry is required to grasp the materials presented in this talk.

**Geometry & Physics**
**Wednesday, February 27, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Jun Li (Stanford)**
*Categorification of DT invariants and GV numbers (Joint with Algebraic geometry seminar)*

DT invariants are degrees of the virtual cycles of the moduli of sheaves on Calabi-Yau threefolds. Behrend's function allows to reconstruct these invariants via weighted Euler numbers, thus can define DT-invariants motivically. A categorification of DT invariants search for perverse sheaves on these moduli
spaces so the Behrend function is the local Euler numbers of cohomology sheaves of these perverse sheaves. In a joint work with YH Kiem, we construct such perverse sheaves, with MHM structures. As a corollary, we define GV numbers via a double sl2 representations on 2-branes.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Algebraic Geometry**
**Wednesday, February 27, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Jun Li (Stanford)**
*Categorification of DT invariants and GV numbers*

DT invariants are degrees of the virtual cycles of the moduli of sheaves on Calabi-Yau threefolds. Behrend's function allows to reconstruct these invariants via weighted Euler numbers, thus can define DT-invariants motivically. A categorification of DT invariants search for perverse sheaves on these moduli spaces so the Behrend function is the local Euler numbers of cohomology sheaves of these perverse sheaves. In a joint work with YH Kiem, we construct such perverse sheaves, with MHM structures. As a corollary, we define GV numbers via a double sl2 representations on 2-branes.

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, February 27, 2013, 4:00pm-6:00pm**
**3096 East Hall**
**Ralf Spatzier (U Michigan)**
*Automorphisms of Convex Projective Cones*

After a little more survey, I will start to discuss the results of Benoist' Invnetiones paper on automorphisms of convex projective cones and a dichotomy on Zariski density.

**Analysis/Probability**
**Wednesday, February 27, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Artem Zvavitch (Kent State University)**
*Some remarks on Mahler's conjecture for convex bodies*

The volume product (Mahler volume) of origin symmetric convex body K is just a product of volume of K and its its dual/polar body. It turned out to be quite a useful object in Functional Analysis and Convex Geometry. Santalo inequality tell us that the volume product takes its maximal value at the Euclidean Ball. Mahler conjectured that the volume product is minimized by a cube. Despite many important partial results, the conjecture is still open in dimensions 3 and higher. In this talk we will discuss some recent progress and ideas concerning this conjecture.

**Financial/Actuarial Mathematics**
**Thursday, February 28, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Darinka Dentcheva (Stevens Institute of Technology)**
*Risk-averse optimization via stochastic order constraints*

Stochastic orders formalize preferences among random outcomes and are widely used in statistics and economics. We focus on stochastic optimization problems involving stochastic order relations as constraints. These constraints relate performance functionals, depending on our decisions to benchmark random outcomes shaping the risk according to the distribution of the benchmark. Necessary and sufficient conditions of optimality and duality theory for these problems will be presented. The analysis puts additional light on the expected utility theory, the dual (rank-dependent) utility theory, and the theory of coherent measures of risk. We prove that Lagrange multipliers associated with two different formulations of these constraints can be identified with utility functions, or with rank-dependent utility functions. Furthermore, we demonstrate that mean-risk models with law invariant coherent risk measures appear as Lagrangian relaxations of the problem with stochastic dominance constraints. The optimization models with stochastic order constraints provide a link between various approaches for risk-averse optimization.

The results contribute to the theory of composite optimization in vector spaces because the stochastic order relations are defined by a continuum of compositions of convex non-smooth functions with possibly non-convex smooth functions.

Implications for portfolio optimization will be discussed.

**Commutative Algebra**
**Thursday, February 28, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Jesse Burke (UCLA)**
*Graded matrix factorizations and complete intersections*

In this talk I will describe how ideas of Orlov can be used to show that modules over a complete intersection ring are equivalent to graded matrix factorizations of the "universal intermediate hypersurface" of the ring. I will illustrate this with examples and show how the equivalence gives information on free resolutions over complete intersections.

**Differential Equations**
**Thursday, February 28, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Tai-Ping Liu (Academia Sinica, Taipei)**
*Solving Boltzmann Equation - The Green's function approach*

**Math Club**
**Thursday, February 28, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Igor Kriz (Univ. of Michigan)**
*The Beauty of Statistical Tests*

I will discuss the rather beautiful and striking properties of the normal (Gaussian) distribution, and why it plays such a prominent role in statistics. I will relate the multivariable Gaussian distribution to finding the principal axes of an ellipse. Then I discuss the mathematics behind two famous statistical tests: the chi-squared test and the Student t test. (The talk is informal, no knowledge of probability theory is assumed.)

**Logic**
**Thursday, February 28, 2013, 4:00pm-5:30pm**
**2866 East Hall**
**Scott Schneider (University of Michigan)**
*Countable locally nilpotent group actions and hyperfinite equivalence relations*

An equivalence relation E is hyperfinite if E is the increasing union of a sequence of Borel equivalence relations with finite classes. In 1982 Weiss proved that any orbit equivalence relation arising from a Borel action of Z is hyperfinite, and asked whether this property is shared by larger classes of countable groups. We survey this question and discuss recent positive answers to it by Gao and Jackson for abelian groups, and by Seward and the speaker for free actions of locally nilpotent groups.

**Student Analysis**
**Thursday, February 28, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**Joe Roberts (University of Michigan)**
*Ill Posed Problems*

In PDE, a problem consists of one or more partial differential equations along with boundary and/or initial data. A well posed problem has a unique solution that depends continuously on the data in some suitable topology. An ill posed problem is then a problem in which at least one of existence, uniqueness, or continuous dependence fails to hold. Obtaining existence and uniqueness usually means finding the right number of conditions to impose, while obtaining continuous dependence usually means finding the right kinds of conditions to impose. I'll go over some classical examples of ill posed problems demonstrating some different ways things can go badly. The talk will be accessible to those without much knowledge of PDE's.

**Theoretical Computer Science**
**Friday, March 01, 2013, 10:00am-11:00am**
**411 West Hall**
**Ely Porat (BIU/UM)**
*Sketching For Big Data Recommender Systems Using Fast Pseudo-Random Fingerprints*

A key building block for collaborative filtering recommender systems is finding users with similar consumption patterns. Given access to the full data regarding the items consumed by each user, one can directly compute the similarity between any two users. However, for massive recommender systems such a naive approach requires a high running time and may be intractable in terms of the space required to store the full data. One way to overcome this is using sketching, a technique that represents massive datasets concisely, while still allowing calculating properties of these datasets. Sketching methods maintain very short fingerprints of the item sets of users, which allow approximately computing the similarity between sets of different users. The state of the art sketch has a very low space complexity, and a recent technique shows how to exponentially speed up the computation time involved in building the fingerprints. Unfortunately, these methods are incompatible, forcing a choice between low running time or a small sketch size. We propose an alternative sketching approach, which achieves both a low space complexity similar to that of [22] and a low time complexity similar to [14]. We empirically evaluate our algorithm using the Netflix dataset.We analyze the running time and the sketch size of our approach and compare them to alternatives. Further, we show that in practice the accuracy achieved by our approach is even better than the accuracy guaranteed by the theoretical bounds, so it suffices to use even shorter fingerprints to obtain high quality results.

**Applied Interdisciplinary Mathematics**
**Friday, March 01, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**John Boyd (Atmospheric, Oceanic, and Space Sciences, University of Michigan)**
*Hermite function interpolation on a finite interval and the interrelationships of polynomial and radial basis functions*

Radial basis functions (RBFs) are class of spectral basis functions that often succeed where polynomial interpolation fails. For example, RBFs can be successfully applied to irregular domains punctuated by islands and peninsulas on a "truncated uniform grid". This is constructed by embedding irregular domain in a rectangle, constructing uniform grid with a rectangle, then deleting all points which lie outside the chosen irregular domain. Multivariate polynomial interpolation is a complete disaster on such a grid because it usually diverges due to the Runge phenomenon. But what is the magic? What is the secret of RBFs?

In previous work, I showed that the RBF cardinal functions for five different species on an unbounded, uniform grid were, to a high degree of accuracy, the product of the sinc function, $\sin(\pi x)/(\pi x)$, with $(\pi x)(\rho \sinh([\pi/\rho]x)$. In this sense, Gaussian, sech, inverse quadratic, multiquadric and inverse multiquadric RBFs are really all the same. Equally significant, this analysis shows that RBF cardinal functions are *spatially localized*, decaying exponentially away from their peak, in contrast to the sinc cardinal functions, which decay only as $1/|x|$.

Extending these studies shows that RBF cardinal functions on a finite uniform grid are, to a high degree of approximation, the product of polynomial cardinal functions with a Gaussian. This suggests approximating functions on a finite interval by the product of a Gaussian with a polynomial. This is equivalent to a basis of Hermite functions, usually employed only for an unbounded domain. The Runge phenomenon, which is the divergence of interpolation on a finite, uniform grid, is greatly reduced. Although motivated by similarities to radial basis functions, the Hermite function interpolants are superior in accuracy, condition number and efficiency in much of the numerical parameter space. In particular, no matrix inversion is required.

**Kottwitz Seminar**
**Friday, March 01, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Charle Stibitz (UM)**
*Spectra and Cohomology Theories, part 4*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Combinatorics**
**Friday, March 01, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Alexander Barvinok (University of Michigan)**
*Thrifty approximations of convex bodies by polytopes*

Given a d-dimensional convex body C containing the origin in its interior and a real t>1, we seek to construct a polytope P with as few vertices as possible such that P is contained in C and C is contained in tP. I plan to present a construction which breaks some long-held records and is nearly optimal for a vide range of parameters d and t. The construction uses the maximum volume ellipsoid, the John decomposition of the identity and its recent sparsification by Batson, Spielman and Srivastava, Chebyshev polynomials, and some tensor algebra.

**Colloquium Series**
**Tuesday, March 05, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Winter Break ()**
*TBA*

**Student AIM Seminar**
**Wednesday, March 06, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**()**
*Spring Break. No Talk*

**Student Analysis**
**Thursday, March 07, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**()**
*No Talk (Spring Break)*

**Student Geometry/Topology**
**Monday, March 11, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Tengren Zhang (UM)**
*What are Affine Spheres?*

The goal of this talk is to define affine spheres and describe some of their properties. We will begin by giving a brief description of some affine invariants, such as the affine normal and the shape parameter, of hypersurfaces embedded in affine space. Then, we will define affine spheres, and give some typical examples. Finally, we will state some local and global classification theorems. To make the talk accessible, I will focus on the case where the affine space is 3-dimensional.

**Geometry & Physics**
**Monday, March 11, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Si Li (BU)**
*Landau-Ginzburg B-model at higher genus*

Given a quasi-homogeneous polynomial with isolated singularity, I will describe a construction of quantum intersection theory on the Jacobian ring via a rigorous perturbative renormalization of a twisted version of Kodaira-Spencer gauge theory. This gives a mathematical theory of Landau-Ginzburg B-model at higher genus, which is expected to mirror to the FJRW theory of orbifold Landau-Ginzburg A-model at all genera.

**Student Combinatorics Seminar**
**Monday, March 11, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Kevin Carde (UM)**
*Distributive Lattices*

It is remarkable that the simple definition of a partially ordered set can lead to such a rich theory. Even better, some posets have additional structure, allowing us to say even more about them. Lattices are one of the foremost examples of a class of nice posets. But even better, some lattices have additional structure, allowing us to say even more. In this talk, I'll introduce distributive lattices, the nicest of these nice posets, and I'll touch on a variety of topics, from finite topologies to Monte Carlo algorithms for generating random combinatorial objects.

**Teaching Mathematics**
**Monday, March 11, 2013, 5:15pm-6:30pm**
**3096 East Hall**
**Michael Weiss (Michigan State Univ)**
*More than Problem-Solving: Mathematical Practices Beyond the Common Core*

The Common Core Standards, with its articulation of eight Mathematical Practices, has placed a welcome emphasis on the kind of thinking mathematicians engage in when problem-solving. But problem-solving is only one facet of mathematical work. More than anything, what distinguishes authentic mathematics from classroom math is problem-posing -- wondering about and seeking to discover what is (or might be) true. In this talk I will provide a taxonomy of problem-posing "moves", and discuss what makes some problems worth asking, and some results worth knowing. I also present examples of how these mathematical practices and values can be embedded in classroom work and in assessment.

**Geometry & Physics**
**Tuesday, March 12, 2013, 2:00pm-3:30pm**
**Randall Lab 4404**
**Kentaro Hori (IPMU)**
*D-brane (FRG Special Lectures)*

**What is... ?**
**Tuesday, March 12, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**Andreas Blass (University of Michigan)**
*What Is ... Ingleton's Inequality?*

Consider a finite-dimensional vector space and a finite sequence of linear subspaces. Consider also the subspaces obtainable as sums of subsequences of the given sequence. What can one say about the dimensions of such sums? Perhaps surprisingly, there are nontrivial things to be said; Ingleton's inequality is the simplest of these. Perhaps more surprisingly, although some further inequalities beyond Ingleton's are known, there might be more that are still unknown. I'll describe this situation and, if time permits, a couple of related situations outside linear algebra.

**Financial/Actuarial Mathematics**
**Tuesday, March 12, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Steve Shreve (Carnegie Mellon University)**
*Diffusion scaling of a limit-order book model*

With the movement of trading away from the trading floor onto electronic exchanges - and the accompanying rise in the volume of order submission - has come an increase in the need for tractable mathematical models of the whole limit order book. The problem is inherently high-dimensional and the most natural description of the dynamics of the order flows has them depend on the state of the book in a discontinuous way. We examine a popular discrete model from the literature and describe its limit under a diffusion scaling inspired by queueing theory. Interesting features include a process which is either "frozen" or diffusing according to whether another diffusion is positive or negative. This is joint work with Christopher Almost and John Lehoczky.

**Colloquium Series**
**Tuesday, March 12, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Mike Hopkins (Harvard University)**
*Ziwet Lectures: Lecture I: The Kervaire invariant problem*

Lecture I: The Kervaire invariant problem

Abstract: In this talk I will describe the history of the Kervaire invariant problem and its solution by Mike Hill, myself, and Doug Ravenel.

Lecture II: Equivariant homotopy theory and the solution to the Kervaire invariant problem.

Abstract: Our solution to the Kervaire invariant problem made essential use of group actions in algebraic topology. In this talk I will describe some of the basic ideas in equivariant homotopy theory and how they are used to study the Kervaire invariant problem.

Lecture III: Equivariant multiplicative closure

Abstract: The "multiplicative closure" of a set of elements in a commutative ring is the set of all products of powers of those elements. One of the innovations used in our solution to the Kervaire invariant problem revealed an unexpected subtlety in the analogue of this notion in equivariant homotopy theory. In this talk I will describe this analogy and explain the subtlety and the structures needed to deal with it.

**Topology**
**Wednesday, March 13, 2013, 3:00pm-4:00pm**
**1372 East Hall**
**Michael Hopkins (Harvard University)**
*Ziwet Lecture II: Equivariant Homotopy Theory and the Solution to the Kervaire Invariant Problem*

Our solution to the Kervaire invariant problem made essential use of group actions in algebraic topology. In this talk I will describe some of the basic ideas in equivariant homotopy theory and how they are used to study the Kervaire invariant problem.

**Student Commutative Algebra**
**Wednesday, March 13, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Sarah Mayes (UM)**
*Applications of commutative algebra to game theory*

In this talk we will use examples to illustrate how polynomials arise from simple games and discuss how techniques from computational algebra may be used to solve problems from game theory.

**Student AIM Seminar**
**Wednesday, March 13, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Xiaolin Wang (University of Michigan)**
*A numerical study of vorticity-enhanced heat transfer*

The Glezer lab at Georgia Tech has found that vorticity produced by vibrated reeds can improve heat transfer in electronic hardware. Vortices enhance forced convection by boundary layer separation and thermal mixing in the bulk flow. In this work, we simulate the heat transfer process in a 3-dimensional plate-fin heat sink. We propose a simplified model by considering flow and temperature in a 2-D channel. We simulate periodically steady-state solutions. We classify several types of the vortex street and determine how the global Nusselt number is increased, depending on the vortices' strengths and spacings, in the parameter space of Reynolds and Peclet numbers.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Algebraic Geometry**
**Wednesday, March 13, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Anton Khoroshkin (Stonybrook)**
*Syzygies via Lie algebra cohomology*

I will explain the isomorphism between the space of syzygies of arbitrary projective quadratic embeddings and certain Lie algebra cohomology. The isomorphism is based on Koszul duality theory. As an illustration we calculate syzygies of the Plucker embedding of the Grassmannian of 2-dimensional planes.

Talk is based on a joint work with A.Gorodentsev, A.Rudakov math.arxiv:0602316

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, March 13, 2013, 4:00pm-5:00pm**
**3096 East Hall**
**Ralf Spatzier (U Michigan)**
*Benoist' dichotomy on Zariski density*

I will explain more on Benoist' dichotomy on Zariski density

**Geometry & Physics**
**Thursday, March 14, 2013, 2:00pm-3:30pm**
**Randall Lab 4404**
**Kentaro Hori (IPMU)**
*D-brane (FRG Special Lectures)*

**Commutative Algebra**
**Thursday, March 14, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Will Traves (US Naval Academy)**
*From Pascal's Theorem to Constructible Curves*

When he was 16 years old, Blaise Pascal extended a famous geometric result due to Pappus (4th century A.D.). Pascal's theorem and Pappus's theorem have been the inspiration for a lot of nice mathematics. We'll review their results and extend their theorems to higher degree curves. I'll discuss connections to linkage and secant varieties, and I'll give a new theorem on elliptic curves. This is joint work with Mike Roth (Queen's University).

**Topology**
**Thursday, March 14, 2013, 3:00pm-4:00pm**
**3088 East Hall**
**Michael Hopkins (Harvard University)**
*Ziwet Lecture III: Equivariant multiplicative closure*

The "multiplicative closure" of a set of elements in a commutative ring is the set of all products of powers of those elements. One of the innovations used in our solution to the Kervaire invariant problem revealed an unexpected subtlety in the analogue of this notion in equivariant homotopy theory. In this talk I will describe this analogy and explain the subtlety and the structures needed to deal with it.

**Differential Equations**
**Thursday, March 14, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Jason Metcalfe (Univ. of North Carolina, Chapel Hill)**
*Local well-posedness for quasilinear Schrodinger equations with rough data*

We will discuss recent joint works with J. Marzuola and D. Tataru that focus on local existence for generic quasilinear Schrodinger equations with data in low regularity spaces. The Mizohata integrability conditions plays an essential role in choosing appropriate spaces, and in order to incorporate the necessary decay, we choose Sobolev spaces that are adapted to include a summability over a partition of space into cubes. The primary estimate is a local smoothing estimate, which is adapted to these spaces.

**Math Club**
**Thursday, March 14, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Selim Esedoglu (Univ. of Michigan)**
*Math in Computer Vision*

Teaching computers to "see" has enormous potential for applications (in medicine, defense, etc.), but turns out to be immensely challenging. Even the task of discerning a foreground object from the background turns out to be enormously hard. I will discuss some of the approaches to this question, and give a flavor of the mathematics involved.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Logic**
**Thursday, March 14, 2013, 4:00pm-5:30pm**
**2866 East Hall**
**Daniel Hathaway (Univ. of Michigan)**
*Fusion in Sacks Forcing*

Fusion is a technique that comes up when dealing with certain kinds of forcings. The basic idea is that we want infinitely many statements to hold in a forcing extension simultaneously, so if we delicately pick forcing conditions which force each these statements, we can "fuse" the conditions together into a single one, which witnesses all of the statements holding in a single extension. This technique is used in Sacks forcing, which is what the talk will be about. Recall that this forcing is the set of all perfect trees on the natural numbers ordered by inclusion. I will present some arguments that use fusion, including a proof that Sacks forcing has "continuous readings of names".

**SPECIAL EVENT**
**Friday, March 15, 2013, 12:00am-12:00am**
**Mathematics Atrium**
**()**
*Graduate Recruitment Weekend*

**Applied Interdisciplinary Mathematics**
**Friday, March 15, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Andrew Wynn (Imperial College)**
*Optimal Mode Decomposition: a new technique to analyse fluid flow data*

Many techniques exist to extract coherent information from a large sample of flow-field data such as an ensemble of PIV snapshots. Examples include Proper Orthogonal Decomposition, introduced to the fluids community in the 1960s, and Dynamic Mode Decomposition (DMD), developed by Schmid in 2010. Such techniques identify intrinsic mode shapes from the data set which can be used, for example, as a basis to construct a Galerkin approximation for the underlying system.

In this talk a new modal decomposition technique, Optimal Mode Decomposition, is presented and it is shown that it can be viewed as an improvement to and generalization of DMD. For a given dimension, the technique provides the optimal (in a sense to be defined in the talk) linear approximation to data's evolution by a system of that dimension. Such low-order flow representations are important, for example, if a control system is to be designed to influence the flow.

**Geometry**
**Friday, March 15, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Dave Futer (Temple )**
*Surface quotients of hyperbolic buildings*

Bourdon's building is a negatively curved 2-complex built out of hyperbolic right-angled polygons. Its automorphism group is large (uncountable) and remarkably rich. We study, and mostly answer, the question of when there is a discrete subgroup of the automorphism group such that the quotient is a closed surface of genus g. This involves some fun elementary combinatorics, but quickly leads to open questions in group theory and number theory.

One consequence of our construction is that a lattice in the automorphism group of Bourdon's building always contains a surface subgroup. This proves a special case of Gromov's surface subgroup conjecture. Joint work with Anne Thomas.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Combinatorics**
**Friday, March 15, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Bruce Sagan (Michigan State University)**
*Factoring the characteristic polynomial of a poset*

Given a poset P, its characteristic polynomial x(P;t) is the generating function in the variable t for the Moebius function of P. For many families of posets, every root of x(P;t) is in the set P of positive integers. A number of different techniques have been devised for showing that x(P;t) factors over P including Zaslavsky's theory of signed graphs, results by Saito and Terao about free hyperplane arrangements, and Stanley's Supersolvability Theorem. We will present a new, totally combinatorial method for proving factorization. This is joint work with Joshua Hallam.

**SPECIAL EVENT**
**Saturday, March 16, 2013, 12:00am-12:00am**
**Mathematics Atrium**
**()**
*Graduate Recruitment Weekend*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Mathematical Biology**
**Monday, March 18, 2013, 12:00pm-1:00pm**
**335 West Hall**
**Gennady Cymbalyuk (Neuroscience Institutue, Georgia State University)**
*Cellular mechanisms controlling temporal characteristics of neuronal activity*

Central pattern generating neuronal networks control and coordinate rhythmic movements. In many such networks, the phase relations of activities of neurons are conserved over a range of values of cycle period. How temporal characteristics are maintained in oscillatory networks is an open question. We model cell intrinsic mechanisms that control temporal characteristics and produce phase maintenance in neuronal networks. We focus on the coregulation of a potassium current (IK) and a hyperpolarization-activated current (Ih). The dynamics of this model are governed by a codimension-2 bifurcation: the cornerstone bifurcation. The bifurcation satisfies conditions for the saddle-node bifurcation on invariant circle (SNIC) and the blue sky catastrophe. For parameter values close to the bifurcation, we achieved control over the burst duration and interburst interval by varying the voltages of half activation of IK and Ih. Similarly we were able to control the latency to spiking after inhibition in a spiking neuron and the duration of single evoked bursts in a silent neuron. We constructed a series of network motifs for central pattern generators typical for motor control and demonstrated how control of bursting activity on the level of individual cells controls phase constancy.

**Group, Lie and Number Theory**
**Monday, March 18, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Ari Shnidman (UM)**
*p-adic heights of algebraic cycles*

The Gross-Zagier formula is a key tool in the proof of the Birch and Swinnerton- Dyer conjecture (BSD) for elliptic curves over Q of analytic rank less than 2. I'll tell this story and discuss generalizations to higher dimensional varieties. In this setting, BSD is replaced by a beautiful conjecture of Beilinson and Bloch which relates ranks of Chow groups to the order of vanishing of L-functions attached to cohomology groups. In the second hour I'll discuss recent work generalizing Nekovar's p-adic version of the Gross-Zagier formula (the weight two case is due to Perrin-Riou).

**Student Algebraic Geometry**
**Monday, March 18, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Brooke Ullery (UM)**
*Introduction to Boij-Soderberg Theory*

Every graded module has a corresponding Betti table: an invariant describing the structure of its minimal free resolution. We can think of these tables as lying in an infinite-dimensional rational vector space. A natural question that arises is which elements of this vector space are realized as Betti tables of modules? Bioj-Soderberg Theory attempts to answer this question (among others).

**Geometry & Physics**
**Monday, March 18, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Simon Rose (Queens University)**
*Counting Hyperelliptic curves in Abelian surfaces with Quasi-modular forms*

In the first part of this talk I will go over some famous results in the theory of curve counting on surfaces, as well present a formula for the number of hyperelliptic curves in a fixed polarized Abelian surface. In the second part I will go into more detail about this formula and its origins in orbifold Gromov-Witten theory, using results from the first part and the crepant resolution conjecture of Bryan-Graber.

**Student Combinatorics Seminar**
**Monday, March 18, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Chris Fraser (UM)**
*Statistical Mechanics and Enumerative Combinatorics*

Statistical mechanics and enumeration are fundamentally intertwined. In the first few minutes of the talk, I will allude to a number of different situations where statistical mechanical ideas have informed combinatorics/optimization, and discuss what statistical mechanics "is all about."
After that, I will consider the Ising model in detail. I will discuss the combinatorial formulation of the partition function for the 2D Ising model on the square lattice. Time permitting, I hope to completely solve this model.

**Geometry & Physics**
**Tuesday, March 19, 2013, 2:00pm-3:30pm**
**Randall Lab 4404**
**Kentaro Hori (IPMU)**
*D-brane (FRG Special Lectures)*

**What is... ?**
**Tuesday, March 19, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**John Schotland (University of Michigan)**
*What is ... the inverse problem?*

This is an introductory talk on inverse problems for PDEs and their relation to imaging. We will focus on the Calderon problem, which consists of determining the electrical conductivity of a medium from boundary measurements. We will survey what is known about this problem and its cousin, the inverse scattering problem for waves in random media.

**Colloquium Series**
**Tuesday, March 19, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**David Fisher (Indiana University )**
*Quasi-isometric rigidity of polycyclic groups*

In his 1983 ICM address, Gromov proposed a program to classify finitely generated groups up to quasi-isometry. This program is a central part of geometric group theory. A major part of the program consists of showing that various classes of groups are quasi-isometrically rigid, i.e. that any group quasi-isometric to a group in the class is also in the class.

Eskin, Whyte and I conjecture that the class of polycyclic groups is quasi-isometrically rigid and proved quasi-isometric rigidity of the three dimensional polycyclic groups. A key ingredient is a new technique which we call coarse differentiation. This technique allows us to define a kind of derivative of a quasi-isometry despite the fact that quasi-isometries need not even be continuous.

I will discuss current progress towards proving our conjecture. Parts of this are joint with Eskin, Peng and Whyte.

**Student Arithmetic**
**Wednesday, March 20, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Julian Rosen (UM)**
*TBA*

**Student Commutative Algebra**
**Wednesday, March 20, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Linquan Ma (UM)**
*Colon-capturing*

We will discuss the colon-capturing property of tight closure and give the definition of F-rational ring, and also discuss some connections to local cohomology.

**Student AIM Seminar**
**Wednesday, March 20, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Hamed Razavi (University of Michigan)**
*Bipedal Robots*

More than 50 percent of the earth's landmass is terrain that is too rough for the wheeled vehicles to access! This is one of the reasons that scientists are trying to develop legged robots, which unlike wheeled vehicles can use isolated footholds that optimize support and traction. However, controlling legged robots in a way that they are stable and at the same time have a high level of mobility is known to be very difficult. This is mostly due to a lack in theory rather than technology!

In this talk, I explain the problem of bipedal robot control and some of the methods that have been used to solve the problem. I show some videos of MABEL, a biped robot at University of Michigan. Also, I will show the simulations of a three dimensional robot I've been working on recently.

**Algebraic Geometry**
**Wednesday, March 20, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Morgan Brown (UM)**
*The McKay correspondence*

Let $G$ be a subgroup of $SL_n(\mathbb{C})$. The classical McKay correspondence relates the representation theory of $G$ with the structure of a minimal resolution of $\mathbb{C}^n/G$. For $n=3$, Bridgeland, King, and Reid used categorical techniques to show that $\mathbb{C}^n/G$ has a distinguished crepant resolution $G$-Hilb.

In the first half I will demonstrate a technique due to Craw and Reid for constructing $G$-Hilb in the toric case (when $G$ is abelian). In the second half I will introduce derived equivalences and their relation to birational geometry, with the $3$ dimensional McKay correspondence as a motivating example.

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, March 20, 2013, 4:10pm-6:00pm**
**3096 East Hall**
**Andrew Zimmer (U Michigan)**
*Dynamics of the geodesic flow on divisible strictly convex sets*

In "Convexes Divisible I," Benoist proved that the following are equivalent for properly convex divisible sets (1) strict convex boundary (2) Gromov hyperbolic dividing group (3) C1 boundary (4) Anosov geodesic flow. I plan to carefully go through the details of Benoist's proof.

**Topology**
**Thursday, March 21, 2013, 12:00am-12:00am**
**3866 East Hall**
**Asaf Hadari (Yale)**
*Homological Shadows of Attracting laminations*

Let $S$ be a surface with punctures, and let $f \in Mod(S)$ be a pseudo-Anosov mapping class. Associated to f is an attracting lamination $L$, which is the limit under the forward orbit of $f$ of any closed curve on $S$. We address the following question - is there a natural way to associate to $L$ some natural object in the homology of $S$? If so, can it be described using some limiting process? What would such an object tell us about $f$? We show that there is indeed such an object, and that it possesses a surprising amount of structure. For instance, if $f$ is in the Torelli group, then the homological lamination will be a convex polyhedron with rational vertices.

**SPECIAL EVENT**
**Thursday, March 21, 2013, 1:00pm-3:00pm**
**1060 East Hall**
**Stephen DeBacker (UM)**
*Working Seminar on Representation Theory*

We will be working to understand the recent work of Tasho Kaletha. In particular, we will be looking at his papers that "establish" the Langlands correspondence for depth zero L-packets for unramified groups and their inner forms. Much of the effort will be directed towards understanding the endoscopic aspects of this work.

**Geometry & Physics**
**Thursday, March 21, 2013, 2:00pm-3:30pm**
**Randall Lab 4404**
**Kentaro Hori (IPMU)**
*D-brane (FRG Special Lectures)*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Financial/Actuarial Mathematics**
**Thursday, March 21, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Igor Cialenco (Department of Applied Mathematics, Illinois Institute of Technology)**
*Dynamic Conic Finance*

We develop a framework for narrowing the theoretical spread between ask prices and bid prices of derivative securities in models of discrete time markets with transaction costs using dynamic coherent acceptability indices studied in Bielecki, Cialenco, and Zhang (2010). Aside from the use of acceptability indices as a tool, our approach is very much rooted in the literature studying good deal bounds as a vehicle to narrow the no-arbitrage interval. We first formulate and prove a no-good-deal version of the fundamental theorem of asset pricing (FTAP) using a family of dynamic coherent risk measures. The obtained results generalize to dynamic market model set-up the version of FTAP proved in Cherny and Madan (2010) in the static conic finance framework. We use the market model setup suitable for dividend-paying securities in markets with transaction costs. Finally, we discuss some applications of this theory to path dependent options and compute the good-deal ask and bid prices generated by dynamic gain-loss ratio (a particular dynamic acceptability index).

**Commutative Algebra**
**Thursday, March 21, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Jenna Rajchgot (University of Michigan)**
*Doubly Universal Grobner bases*

A universal Grobner basis of an ideal in a polynomial ring is a finite set of polynomials which is a (non-reduced, non-minimal) Grobner basis for every monomial order. In this talk, Iâ€™ll explain a way to generalize this notion from ideals in a polynomial ring to an ideal sheaf defining the universal family over a Hilbert scheme, and Iâ€™ll describe the form of such a universal Grobner basis. Iâ€™ll end by discussing an application to studying 1-dimensional torus orbits in a Hilbert scheme. This part is work in progress.
This is joint work with Mathias Lederer.

**Differential Equations**
**Thursday, March 21, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Michael Kiessling (Rutgers University)**
*Nonlinear electromagnetism and the problem of point charge motion*

In the 1930s Max Born suggested that the ultraviolet divergence problems of electrodynamics (both classical and quantum) associated with point charges would not show up if one uses suitable nonlinear field equations. He also suggested that the nonlinear nature of the field equations would determine the motion of the point charges. I review what is known rigorously about his ideas, and whereto they have led us so far.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Math Club**
**Thursday, March 21, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Daniel Erman (Univ. of Michigan)**
*Hilbert's Third Problem*

In 1900 David Hilbert proposed a famous list of 23 open problems. The third problem asked: Given two polyhedra of equal volume, can you always cut the first one into finitely many pieces (with scissors) and reassemble the pieces to form the second? This problem was the first of these problems to be solved, by Hilbert's own student Max Dehn. The answer was ``No" . I will discuss a modern, simplified version of Dehn's proof.

**Logic**
**Thursday, March 21, 2013, 4:00pm-5:30pm**
**2866 East Hall**
**Andreas Blass (Univ. of Mich.)**
*Sacks property and ultrafilter preservation*

I'll begin with a discussion of Sacks forcing and the Sacks property. Afterward, I'll give an application to showing that certain ultrafilters in the ground model are preserved in a Sacks-generic extension. Despite the overlap of topics, I plan not to presuppose Dan Hathaway's talk from last week.

**SPECIAL EVENT**
**Thursday, March 21, 2013, 5:00pm-6:00pm**
**Mathematics Atrium**
**()**
*Social Hour*

Social Hour will be held on Thursday March 21 at 5:10pm at the math atrium, after the differential equation seminar. We will be providing a variety of snacks and beverages. Will look forward seeing you there.

Social Hour is run entirely on voluntary contributions. The suggested amounts are $30/semester for tenured faculty, $20/semester for other faculty, and $5/semester for graduate students. Donations (cash or check) may be given to me in my mailbox. Please make checks out to the University of Michigan.

**Theoretical Computer Science**
**Friday, March 22, 2013, 10:00am-11:00am**
**411 West Hall**
**Arnab Bhattacharyya (DIMACS)**
*Every locally characterized affine-invariant property is testable*

Let F = F_p for any fixed prime p >= 2. An affine-invariant property is a property of functions on F^n that is closed under taking affine transformations of the domain. We prove that all affine-invariant property having local characterizations are testable. In fact, we show a proximity-oblivious test for any such property P, meaning that there is a test that, given an input function f, makes a constant number of queries to f, always accepts if f satisfies P, and rejects with positive probability if the distance between f and P is nonzero. More generally, we show that any affine-invariant property that is closed under taking restrictions to subspaces and has bounded complexity is testable.

We also prove that any property that can be described as the property of decomposing into a known structure of low-degree polynomials is locally characterized and is, hence, testable. For example, whether a function is a product of two degree-d polynomials, whether a function splits into a product of d linear polynomials, and whether a function has low rank are all examples of degree-structural properties and are therefore locally characterized.

Our results depend on a new Gowers inverse theorem by Tao and Ziegler for low characteristic fields that decomposes any polynomial with large Gowers norm into a function of low-degree non-classical polynomials. We establish a new equidistribution result for high rank non-classical polynomials that drives the proofs of both the testability results and the local characterization of degree-structural properties.

Joint work with Eldar Fischer, Hamed Hatami, Pooya Hatami, and Shachar Lovett.

**Applied Interdisciplinary Mathematics**
**Friday, March 22, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Aaron King (Ecology and Evolutionary Biology, University of Michigan)**
*Using mathematics to explain and forecast infectious disease dynamics*

Stochastic dynamical systems are extremely useful as concise expressions of biological hypotheses. When long time series data are available, they can be used to evaluate these hypotheses, but doing so rigorously is a hard mathematical problem. I'll describe recent work showing how this problem can be effectively solved and highlight some results that change our understanding of the basic ecology of cholera. I'll also present some work demonstrating how stochastic dynamical systems models can be used to provide effective forecasts of severe cholera outbreaks.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Geometry**
**Friday, March 22, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Siu-Cheong Lau (Harvard)**
*An introduction to SYZ mirror symmetry*

The study of mirror symmetry discovered by string theorists has led to revolutionary developments in enumerative geometry in the past two decades. In this talk, I will illustrate mirror symmetry by a simple example, and explain a mathematical approach to study mirror symmetry proposed by Strominger-Yau-Zaslow, which has closed relations with Lagrangian intersection theory.

**Combinatorics**
**Friday, March 22, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Michael Chmutov (University of Michigan)**
*Type A molecules are of Kazhdan-Lusztig type*

Let (W, S) be a Coxeter system. A W-graph is an encoding of a representation of the corresponding Iwahori-Hecke algebra. Especially important examples include the W-graph corresponding to the action of the Iwahori-Hecke algebra on the Kazhdan-Lusztig basis as well as this graph's strongly connected components (cells). In 2008, Stembridge identified some common features of the Kazhdan-Lusztig graphs and gave a combinatorial characterization of all W-graphs that have these features. He conjectured, and checked up to n = 9, that all such A_n-cells are of Kazhdan-Lusztig type. In this talk I will discuss a possible first step toward the proof of the conjecture. More concretely, I will describe why the connected subgraphs of A_n-cells consisting of "simple" (i.e. directed both ways) edges are of Kazhdan-Lusztig type.

**Group, Lie and Number Theory**
**Monday, March 25, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Igor Dolgachev (UM)**
*Cayley property of algebraic groups*

As is well-known, any orthogonal matrix with determinant 1 and no eigenvalues equal to -1 can be obtained as the Cayley transform C(A) = (I-A)(I+A)^{-1} of a skew-symmetric matrix A. This establishes a birational isomorphism between the real orthogonal group and its Lie algebra that is equivariant with respect to the adjoint action of the group on itself and on its Lie algebra. By definition, a linear algebraic group over a field k has the Cayley property is there is exists such a equivariant birational map over k between the group and its Lie algebra. I will discuss some recent work on investigating which algebraic groups satisfy the Cayley property.

**Student Algebraic Geometry**
**Monday, March 25, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**David Stapleton (UM)**
*Toric Blow-ups*

We will discuss the combinatorial data associated to blowing up a toric invariant subvariety of a toric variety.

**Student Geometry/Topology**
**Monday, March 25, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**David Renardy (UM)**
*How to compute hyperbolic volume*

From the Gauss-Bonet theorem, we know that the area of a hyperbolic triangle is determined completely by its three angles. In particular the area of a triangle with angles a, b and c is pi-a-b-c. If the triangle is ideal (i.e. all angles are 0) then the triangle has (maximal) area pi. Given a simplex of higher dimension, how do we compute its volume? What is the maximal volume of a hyperbolic n-simplex? It turns out that maximal volume is achieved by the regular ideal simplex (much as in the n=2 case). The upshot of this result is that many manifolds have rather accessible triangulations in terms of ideal simplices. Knowing the volumes of ideal simplices will allow us to calculate the volume of a given manifold. I will attempt to leave the "computation" in this talk to a minimum (and to computers), relying on diagrams and pictures for most of the arguments. I will also provide some classic examples on the computer using the geometry/topology program Snap Pea.

**Geometry & Physics**
**Monday, March 25, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Siu-Cheong Lau (Harvard)**
*Open mirror theorem and crepant resolutions*

In this talk, I will explain the relation of open Gromov-Witten invariants and Seidel representations for toric manifolds. This leads to an open mirror theorem, which expresses the mirror map in terms of open Gromov-Witten invariants. The theorem has a natural generalization to certain toric orbifolds. As a result we can see how the open invariants of a toric orbifold is linked to that of its crepant resolutions. This is a joint work with Chan, Cho, Leung and Tseng.

**Geometry & Physics**
**Tuesday, March 26, 2013, 2:00pm-3:30pm**
**Randall Lab 4404**
**Kentaro Hori (IPMU)**
*D-brane (FRG Special Lectures)*

**What is... ?**
**Tuesday, March 26, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**Mattias Jonsson (Univ of Michigan)**
*What is a Berkovich space*

When naively trying to do analytic geometry over fields other than the complex numbers, one often encounters various unpleasant facts, such as the spaces in question being totally disconnected or not locally compact. In the late 1980's, Vladimir Berkovich found a way to define analytic spaces with good topological properties over any field equipped with a norm. I will give a gentle introduction to these spaces, now commonly called Berkovich spaces.

**Colloquium Series**
**Tuesday, March 26, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Domingo Toledo (University of Utah)**
*Geometry of Period Domains*

Period domains are homogeneous complex manifolds that appeared in the study of period of integrals and monodromy groups of families of algebraic varieties. They appear now in many different contexts. I will explain some of this history, including how they can be used to study representations of fundamental groups of algebraic varieties, I will also explain recent joint work with P. Griffiths and C. Robles on geometry of these domains.

**Student Arithmetic**
**Wednesday, March 27, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Suchandan Pal (UM)**
*TBA*

**Student Commutative Algebra**
**Wednesday, March 27, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Jenna Rajchgot (UM)**
*F-splitting, Grobner bases, and applications*

I'll attempt to provide a link between the two main themes of this semester's seminar (char. p commutative algebra and applications of commutative algebra) by discussing a theorem of Knutson. I'll then provide examples of how one can use the theorem to study varieties arising in combinatorial commutative algebra.

**Student AIM Seminar**
**Wednesday, March 27, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Yen Ting Lin (University of Michigan)**
*On Interaction between Stochasticity and Nonlinearity: In the Context of Stochastic Competitive Population Dynamics*

Biological dispersal is a classic problem in mathematical biology. One of the core question is, whether there exists an evolutionarily stable (ES) strategy for dispersion. In the deterministic models with passive diffusion, it has been proven that no dispersal is evolutionary stable. However, recent numerical studies showed that demographic fluctuation would enhance dispersal, and the underlying mechanism of the enhancement had not been identified.

This talk will start with heuristic examples, along with one published numerical study by Kessler and Sander in `09, to describe of the problems of interests. After the context is set up, I will present two models we developed to investigate the problem. The objective is to explore whether the evolutionarily stable dispersal rate exists, and if so, how it functionally depends on various parameters of the systems.

This topic is a continuation of our previous proposed "live-fast-die-young" (LFDY) model, which was presented by Prof. Doering in the AIM seminar in January. I will show that, combining the novel asymptotic analysis we proposed in the LFDY-model with a conventional asymptotic analysis, we are able to obtain closed forms of asymptotic solutions of both the dispersal models. Numerical evidence will be presented to support our analysis. I will present the insight of the dynamical mechanisms, which is hinted in the mathematical expressions: the outcome of the competition are due to the nonlinearity and the stochasticity of the system at a high order of asymptotic expansion.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Algebraic Geometry**
**Wednesday, March 27, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**John Lesieutre (MIT)**
*A divisor with non-closed diminished base locus*

I will explain the construction of a pseudoeffective $\mathbb R$-divisor $D$ on the blow-up of $\mathbb P^3$ at nine very general points which has negative intersections with a Zariski dense set of curves. The diminished base locus $\mathbf B_-(D) = \bigcup_{\text{$A$ ample}} \mathbf B(D+A)$ of $D$ is not closed, and $D$ does not admit a Zariski decomposition in even a very weak sense. By a similar method, I'll exhibit an $\mathbb R$-divisor which is nef on very general fibers of a family, but fails to be nef over countably many prime divisors in the base. I'll also discuss some related issues for divisors on Calabi-Yau threefolds.

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, March 27, 2013, 4:00pm-5:30pm**
**3096 East Hall**
**Andrew Zimmer (U Michigan)**
*More on convex divisible sets*

In this we will sketch applications of Benoist's results on the dynamics of the geodesic flow of divisible convex sets and on Zariski density of the dividing group.

**Analysis/Probability**
**Wednesday, March 27, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Mykhaylo Shkolnikov (Berkeley)**
*Large deviations for diffusions interacting through their ranks*

Systems of diffusion processes (particles) with rank-based interactions have been studied heavily due to their importance in stochastic portfolio theory and the intriguing relations with particle systems appearing in statistical physics. We will study the behavior of this particle system as the number of particles gets large. By obtaining a large deviations principle, we will show that the limiting dynamics can be described by a porous medium equation with convection, whereas paths of finite rate are given by solutions of appropriately tilted versions of this equation. This is the first instance of a large deviations principle for diffusions interacting both through the drift and the diffusion coefficients with the diffusion coefficients not being globally Lipschitz (and not even continuous). Based on joint work with A. Dembo, S.R.S. Varadhan and O. Zeitouni.

**Geometry & Physics**
**Thursday, March 28, 2013, 2:00pm-3:30pm**
**Randall Lab 4404**
**Kentaro Hori (IPMU)**
*D-brane (FRG Special Lectures)*

**Financial/Actuarial Mathematics**
**Thursday, March 28, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Mykhaylo Shkolnikov (UC Berkeley)**
*Asymmetrically colliding Brownian particles in stochastic portfolio theory and beyond*

We will discuss systems of Brownian particles on the real line, which interact by splitting the local times of collisions among themselves in an asymmetric manner. These can be identified with the collections of ordered processes in a Brownian particle system, in which the drift coefficients, the diffusion coefficients, and the collision local times for the individual particles are assigned according to their ranks. Such processes can be viewed as generalizations of those arising in first-order models for equity markets in the context of stochastic portfolio theory, and are able to correct for several shortcomings of such models while being equally amenable to computations. We also show that, in addition to being of interest in their own right, such systems of Brownian particles arise as universal scaling limits of systems of jump processes on the integer lattice with local interactions. In particular, this result extends the convergence of TASEP to its continuous analogue.

This is joint work with Ioannis Karatzas and Soumik Pal.

**Topology**
**Thursday, March 28, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Thomas Koberda (Yale)**
*Curve complexes for right-angled Artin groups.*

I will discuss an analogue of the curve complex for right-angled Artin groups and describe some of its properties. I will then show how it guides parallel results between the theory of mapping class groups and the theory of right-angled Artin groups. This represents joint work with S. Kim.

**Commutative Algebra**
**Thursday, March 28, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Florian Enescu (Georgia State University)**
*On strong test ideals*

The talk will discuss a couple of problems about strong test ideals in tight closure theory, and present a new class of such ideals related to algebra pairs.

**Math Club**
**Thursday, March 28, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Scott Schneider (Univ. of Michigan)**
*The Banach-Tarski Paradox*

In 1924, Banach and Tarski proved that any bounded solid region in 3-space can be decomposed into finitely many pieces that can be rearranged using Euclidean isometries to produce any other bounded solid region desired. As it is often put, "a pea can be chopped up and reassembled to produce the sun." I will present this paradoxical result and discuss the extent to which the Axiom of Choice can be blamed for it.

**Differential Equations**
**Thursday, March 28, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Cindy Keeler (UMICH Dept. Physics)**
*From Navier-Stokes to Einstein*

I will discuss a mapping between solutions of the incompressible Navier-Stokes equations and the vacuum Einstein equations, mostly focussing on work with Bredberg, Lysov, and Strominger.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Analysis/Probability Learning Seminar**
**Thursday, March 28, 2013, 4:10pm-6:00pm**
**4096 East Hall**
**Pierre Youssef (Paris-Est Marne-la Vallee University)**
*On some column selection problems and applications*

Given U an nÃ—m matrix, the aim is to extract a large number of linearly independent columns of U and estimate the smallest and the largest singular value of the restricted matrix. For that, we give two deterministic algorithms: one for the restricted invertibility principle dealing with the smallest singular value, and one for the norm of coordinate restriction problem dealing with the largest singular value. Merging the two algorithms, we are able to extract a well-conditioned block inside U, improving a previous result due to Vershynin. We give some applications of this result, among them a deterministic algorithm to get the best known result on the Kadison-Singer conjecture.

**Student Analysis**
**Thursday, March 28, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**Jeff Calder (University of Michigan)**
*A Hamilton-Jacobi equation for the continuum limit of non-dominated sorting*

Given a finite partially ordered set, one can arrange the points in the set into layers in the following way. The first layer is the set of minimal elements with respect to the partial order. The second layer is obtained by removing the first layer, and finding the minimal elements in what remains. Further layers are obtained recursively by repeatedly removing the set of minimal elements. When applied to points in Euclidean space with the usual partial order this algorithm is called non-dominated sorting. It is a fundamental algorithm in multi-objective optimization and has connections to many important problems in combinatorics and probability. In this talk I will sketch the proof of a new result which shows that the layers obtained by non-dominated sorting of random points in Euclidean space converge almost surely, in the large sample size limit, to the level sets of a function which satisfies a Hamilton-Jacobi equation in the viscosity sense. The talk will be at a basic level and will be accessible to all graduate students.

**RTG Workshops/Lectures**
**Friday, March 29, 2013, 1:00pm-2:00pm**
**B 844, East Hall**
**Vadim Kaimanovich (U Ottawa)**
*Random walks and Poisson boundaries; entropy and the Liouville property*

We shall give a general introduction to the boundary theory of random walks on groups starting from general notions and illustrating them on concrete examples of groups with hyperbolic properties and self-similar groups.

**RTG Workshops/Lectures**
**Friday, March 29, 2013, 2:15pm-3:15pm**
**B 844**
**Anders Karlsson (U Geneva)**
*An ergodic theorem for noncommuting products*

In this introductory lecture I will recall some classical ergodic theorems (Birkhoff, Kingman, Oseledets) and formulate a rather general ergodic theorem for noncommuting products that appeared in my joint work with F. Ledrappier. This involves the notion of horofunctions which I will spend some time explaining.

**Applied Interdisciplinary Mathematics**
**Friday, March 29, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Brian Arbic (Earth and Environmental Sciences, University of Michigan)**
*Impact of stratification and climatic perturbations to stratification on barotropic tides*

As is well known, tides in a stratified system include a baroclinic, or internal, mode characterized by relatively short horizontal scales and large interfacial displacements at depth. We show here that the introduction of stratification into global numerical tide models changes the large-horizontal scale, or barotropic, tide as well, typically by about 1-5%. Motivated by the impact of stratification on the barotropic tide, we then show that perturbations to the oceanic stratification yield further changes in both the barotropic and baroclinic components of surface tidal elevations. An analytical model of tides in a two-layer system also shows that stratification and perturbations to stratification impact the barotropic as well as baroclinic tides. Taken together, the numerical and analytical results therefore suggest that climatic perturbations to oceanic stratification may contribute to the secular changes in tides seen in tide gauge observations taken over the last century or so. As an aside we note that the analytical tide model shown here is in some ways more general than analytical models of tidal conversion since in our model the entire tidal solution is developed from a given astronomical tidal forcing, whereas in the latter the barotropic tide is taken as a given.<br />
<br />
This will be a "tag-team" presentation by Prof. Arbic and AIM PhD student Alfredo Wetzel.

**RTG Workshops/Lectures**
**Friday, March 29, 2013, 4:00pm-5:00pm**
**B 844**
**Alex Furman (UIC)**
*Products of random matrices: Lyapunov exponents and stationary measures*

In these three talks we shall focus on asymptotic characteristics of products of random i.i.d. matrices, that can be viewed as random walks on matrix groups. Writing the random product in the polar form (KAK decomposition) the behavior of the A-component is described by the Lyapunov exponents, and the distribution of the K-part by the stationary measure. These notions will be introduced in the first lecture.

**Combinatorics**
**Friday, March 29, 2013, 4:10pm-5:00pm**
**3866 East Hall**
**Kevin Carde (University of Michigan)**
*Cluster structures on mixed invariant rings, and related combinatorics*

Let V be a k-dimensional complex vector space. The Pluecker ring of polynomial SL(V) invariants of a collection of n vectors in V can be alternatively described as the homogeneous coordinate ring of the Grassmannian Gr(k,n). In 2003, using combinatorial tools developed by A. Postnikov, J. Scott showed that the Pluecker ring carries a cluster algebra structure. Over the ensuing decade, this has become one of the central examples of cluster algebra theory.

In the 1930s, H. Weyl described the structure of the "mixed" Pluecker ring, the ring of polynomial SL(V) invariants of a collection of n vectors in V and m covectors in V*. We generalize Scott's construction and Postnikov's combinatorics to this more general setting. In particular, we show that each mixed Pluecker ring carries a natural cluster algebra structure. This was previously established by S. Fomin and P. Pylyavskyy in the case k=3.

**RTG Workshops/Lectures**
**Saturday, March 30, 2013, 9:00am-10:00am**
**B 844**
**Vadim Kaimanovich (U Ottawa)**
*Boundary convergence and identification; applications to the mapping class group*

We shall give a general introduction to the boundary theory of random walks on groups starting from general notions and illustrating them on concrete examples of groups with hyperbolic properties and self-similar groups.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**RTG Workshops/Lectures**
**Saturday, March 30, 2013, 10:15am-11:00am**
**B 844**
**Giulio Tiozzo (Harvard U)**
*Geodesic ray tracking for random walks on groups*

Given a finitely generated group G acting on a geodesic space X and a probability measure on G, one can construct a random walk by choosing at each step a random group element and letting it act on X. The natural question arises whether the sample paths can be approximated by some geodesic in X. We will prove that, in a quite general setting, the sample path and the limiting geodesic lie within sublinear distance. Our argument applies to the case of the mapping class group acting on Teichmueller space, answering a question of Kaimanovich. Another application includes the statistics of excursions of random Teichmueller geodesics in the thin part of moduli space.

**RTG Workshops/Lectures**
**Saturday, March 30, 2013, 11:15am-12:15pm**
**B 844**
**Alex Furman (UIC )**
*Lyapunov exponents: positivity of the top exponent, simplicity of the spectrum, regularity*

The second lecture will examine qualitative behavior of the Lyapunov exponents, and some regularity results about Lyapunov exponents and stationary measures.

**RTG Workshops/Lectures**
**Saturday, March 30, 2013, 1:30pm-2:30pm**
**B 844**
**Moon Duchin (Tufts U)**
*Random TeichmÃ¼ller geodesics*

I'll review some of the features and pathologies of geodesics in the TeichmÃ¼ller metric, including the phenomena that are obstructions to hyperbolicity. Then I'll discuss recent work with Dowdall and Masur in which we work out properties enjoyed by generic geodesics, concluding that these obstructions are quantifiably rare, and TeichmÃ¼ller space is in this sense "statistically hyperbolic." One key tool, devised by Eskin and Mirzakhani, shows that geodesics are well-modeled by random walks on a net of points.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**RTG Workshops/Lectures**
**Saturday, March 30, 2013, 2:45pm-3:30pm**
**B 844**
**Andrew Zimmer (U Michigan)**
*The Poisson and Martin boundary of a harmonic manifold*

A complete Riemannian manifold is called harmonic if each geodesic sphere of sufficiently small radii has constant mean curvature. Examples of harmonic manifolds include flat spaces and rank one locally symmetric spaces. The Lichnerowicz conjecture asks if these are the only compact harmonic manifolds. In this talk we will present some evidence that this is the case. In particular, we will discuss various compactifications of non-compact non-flat simply connected harmonic manifolds. We will show that the Martin, Poisson, Busemann, and "geometric" boundaries coincide. Moreover, in this case, the harmonic measure can be identified with "visual" measure. This leads to several corollaries concerning the fundamental group of a compact harmonic manifold and the dynamics of the geodesic flow.

**RTG Workshops/Lectures**
**Saturday, March 30, 2013, 4:00pm-5:00pm**
**B 844**
**Anders Karlsson (U Geneva)**
*An ergodic theorem for noncommuting products II*

In the second talk I will give a proof of the noncommutative ergodic theorem and explain a few of its consequences, notably to the drift of random walks on finitely generated groups and the existence of non-constant bounded harmonic functions improving on a result of Varopoulos.

**Group, Lie and Number Theory**
**Monday, April 01, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Alexei Oblomkov (University of Massachusetts Amherst)**
*The elliptic Affine Springer Fibers in type A and the rational Cherednik Algebras*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Student Algebraic Geometry**
**Monday, April 01, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Robert Auffarth (Pontificia Universidad CatÃ³lica de Chile)**
*Elliptic curves in abelian varieties*

It is well known that the Jacobian of a curve is a principally polarized abelian variety, and the divisor that defines its polarization is irreducible. However, there are examples of Jacobians that are isomorphic as varieties to the product of elliptic curves, and so these must contain a divisor that is as "reducible as possible". We will discuss these examples, and find a nice criterion, using intersection theory, for an abelian variety to contain an elliptic curve.

**Student Geometry/Topology**
**Monday, April 01, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Patrick Boland (UM)**
*SL(2,Z)\SL(2,R)*

We show that the homogeneous space in the title is homeomorphic to a knot complement in the three sphere.Â Thinking of this space as the unit tangent bundle of the modular curve, we discuss results of Ghys and SarnakÂ about linking numbers of geodesics in the modular curve and the missing knot in the three sphere. If time permits,Â we will discuss preliminary results on linking between certain geodesics in the modular curve and generalizations.Â

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Geometry**
**Monday, April 01, 2013, 4:00pm-5:00pm**
**EH 3096**
**Jeff Danciger (UT Austin)**
*Geometric transitions in Lorentzian geometry I*

A complete flat Lorentzian three-manifold is the quotient of the (2+1) dimensional Minkowski space by a group of isometries acting properly discontinuously. If the group acting is a free group, the quotient is called a Margulis space-time. We show that (most) Margulis space-times arise as rescaled limits of collapsing manifolds modeled on anti de Sitter (AdS) geometry, a negatively curved Lorentzian model geometry. This is joint work with FranÃƒÂ§ois GuÃƒÂ©ritaud and Fanny Kassel.
The talk will have two parts. Part I will develop a framework for geometric transitions. Specifically we explain how to make sense of paths of geometric structures that change geometry (e.g. from curved to flat). Part II will focus on the geometry and topology of Lorentzian manifolds, and then give the main construction.

**Student Combinatorics Seminar**
**Monday, April 01, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Rachel Karpman (UM)**
*Puzzles and (equivariant) cohomology of Grassmannians*

The Littlewood-Richardson numbers play an important role in symmetric function theory; in the representation theory of GL(n); and in computing the cohomology of Grassmanians. Knutson and Tao's puzzle rule gives a combinatorial interpretation of these numbers which has several nice symmetries. We will introduce the Puzzle Rule and explore some of the ideas behind the proof, including a combinatorial characterization of the equivariant cohomology ring of the Grassmannian.

**What is... ?**
**Tuesday, April 02, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**Bob Griess (Univ of Michigan)**
*What is moonshine?*

In mathematics, the term ``moonshine'' indicates a surprising connection between distinct areas of mathematics. The term originated in the late 70s concerning connections between the Monster sporadic simple group and the set of genus 0 function fields on the upper half plane. In this lecture, we briefly list about half a dozen moonshine phenomena, involving finite simple groups, number theory and Lie theory. I will describe a few points in detail An ``explanation'' of a moonshine phenomena would probably be some kind of mathematical context where all aspects of the phenomenon are visible and understandable. After three decades, there is hardly anything which qualifies as a real explanation.

**Colloquium Series**
**Tuesday, April 02, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Max Glick (Univ of Michigan)**
*Sumner Myers colloquium: The pentagram map and Y-patterns*

The pentagram map is defined by the following construction: given a polygon as input, draw all of its "shortest" diagonals, and output the smaller polygon which they cut out. This operation was introduced by R. Schwartz in the 1990's and has received considerable attention in the past few years within both the discrete integrable system and cluster algebra communities.

I will explain how expressing the pentagram map in certain cross ratio coordinates makes it possible to realize the map as a sequence of mutations in a cluster algebra. This connection leads to explicit formulas for the iterates of the pentagram map in terms of generating functions. The underlying combinatorial objects driving the formulas are a family of posets which arose in the work of N. Elkies, G. Kuperberg, M. Larsen, and J. Propp on alternating sign matrices.

**Student Arithmetic**
**Wednesday, April 03, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Adam Kaye (UM)**
*Damerell's Theorem on L-functions of Elliptic curves with CM*

Proven in 1970, Damerell's theorem finds the "algebraic part" of certain L-functions attached to elliptic curves with complex multiplication. It was studied in an attempt to make steps toward proving the BSD conjecture, but we will use it to interpolate special values of these L-functions to create p-adic L-functions.

**Student Commutative Algebra**
**Wednesday, April 03, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Luis Nunez-Betancourt (UM)**
*F-purity*

We will define F-purity and mention several properties; in particular, Fedder's Criterion. In addition, we will discuss interactions with rings of differential operators, F-modules, local cohomology, and tight closure.

**Student AIM Seminar**
**Wednesday, April 03, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Alfredo Wetzel (University of Michigan)**
*Whitham Modulation Theory*

Whitham modulation or modulation theory describes the evolution of slowly modulated wave-trains of nonlinear, dispersive partial differential equations (PDEs). In practice, this involves considering the PDE in a certain asymptotic limit so that quantities such as the wavenumber, phase speed, amplitude, etc. of the solution are locally well defined. The theory then consists in obtaining evolution equations, arising from the PDE, for these parameters: the modulation equations. These modulation equations may be found through multiple-scale expansions, through the averaging of conservation laws, or the averaging of the Lagrangian of the system. The method is grounded on intuition and remarkably useful in physical applications such as dispersive shock waves.

I will begin the talk with physical examples of dispersion and the mathematics used to study dispersive waves. I will then discuss the foundations of modulation theory and the construction of the modulation equations. I will finish by showing an application of Whitham modulation theory to solve a dispersive shock problem in a manner akin to the method of matched asymptotic expansions used in ODEs. The talk is intended to be mostly self-contained.

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, April 03, 2013, 4:00pm-6:00pm**
**3096 East Hall**
**Jeff Danciger (UT Austin)**
*Geometric transitions in Lorentzian geometry*

A complete flat Lorentzian three-manifold is the quotient of the (2+1)-dimensional Minkowski space by a group of isometries acting properly discontinuously. If the group acting is a free group, the quotient is called a Margulis space-time. We show that (most) Margulis space-times arise as rescaled limits of collapsing manifolds modeled on anti de Sitter (AdS) geometry, a negatively curved Lorentzian model geometry. This is joint work with FranÃ§ois GuÃ©ritaud and Fanny Kassel.
The talk will have two parts. Part I will develop a framework for geometric transitions. Specifically we explain how to make sense of paths of geometric structures that change geometry (e.g. from curved to flat). Part II will focus on the geometry and topology of Lorentzian manifolds, and then give the main construction.

**Analysis/Probability**
**Wednesday, April 03, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Tamara Grava (SISSA (Italy))**
*Hamiltonian perturbation of elliptic and hyperbolic systems: universality of critical behaviour*

We consider the solution of Hamiltonian perturbations of elliptic and hyperbolic systems. We study the behaviour of solutions of the perturbed system in the neighbourhood of critical points for the solution of the elliptic or hyperbolic systems. We show that such behaviour does not depend either on the equation or on the initial data and it is described by solutions of ODEs of the Painleve' family.

**Financial/Actuarial Mathematics**
**Thursday, April 04, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Jin Ma (USC)**
*Pathwise Stochastic Taylor Expansion and Forward Path-Dependent PDEs*

In this talk we first revisit the notion of pathwise stochastic Taylor ex- pansion, and prove a new result that extends our previous works to a more general setting, in terms of the newly developed notion of path-derivative initiated by Dupire. We will then show how this new form of pathwise Tay- lor expansion could lead to a notion of stochastic viscosity solution for a class of fully nonlinear SPDEs and the corresponding Path-dependent PDEs (PPDEs), without having to invoke the stochastic characteristics for the lo- calization. We will discuss the issues of consistency, stability, and comparison principles for the stochastic viscosity solutions. In the semilinear case, we show that the PPDE, whence the SPDE, is well-posed in our new framework.

This is a joint work with Rainer Buckdahn and Jianfeng Zhang.

**Commutative Algebra**
**Thursday, April 04, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Mel Hochster (University of Michigan)**
*Ideals and algebras generated by forms of degree at most 4 in polynomial rings*

Michael Stillman raised the following question: given n homogeneous polynomials of degree at most d in a polynomial ring over a field, is there a bound on the projective dimension for the ideal they generate that depends on n,d and not on the number of variables? Hilbert proved that the number of variables is a bound. The talk will discuss joint work with Tigran Ananyan which answers this question affirmatively if the forms have degree at most 4, provided the characteristic of the field is not 2 or 3. Results of the following kind over an algebraically closed field play a key role: Given a vector space of quadratic forms of dimension 3, if no nonzero element is in the ideal generated by 27 linear forms, then the quotient by the ideal generated by the quadratic forms is a UFD. We can prove similar results up to degree 4 if the characteristic is not 2 or 3. I.e., for d at most 4, there are functions A(n,d) such that if o nonzero homogeneous element in the vector space spanned by at most n forms is in an ideal generated by A(n,d) elements of lower degree, then the quotient by the ideal generated by any subset of the forms is a unique factorization domain. We conjecture that such results hold in general, if the characteristic is 0 or greater than d.

**Math Club**
**Thursday, April 04, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Daniel Fiorilli (Univ. of Michigan)**
*Prime Number Races*

We will start with a historical introduction to the Riemann zeta function and its connection with prime numbers. this work began with Euler, followed later by Riemann. We will then talk about Chebyshev's assertion that there seem to be more primes of the form 4n+3 than of the form 4n+1. Are there? We will present some surprising facts about such prime number races.

**Differential Equations**
**Thursday, April 04, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Chong-Qing Cheng (Nanjing Univ.)**
*Dynamical Instability of nearly integrable Hamiltonian systems*

Arnold diffusion is one of the most important problems in the field of dynamical systems and has puzzled us for half a century. It asks whether it is typical phenomenon that a higher-dimensional problems is topological instability: through an arbitrarily small neighborhood of any point there passes a phase trajectories along which the slow variables drift away from the initial value by a quantity of order 1.

In this talk, I shall survey recent progress on the topic and sketch our proof of Arnold diffusion in nearly integrable systems with three degrees of freedom.

**Logic**
**Thursday, April 04, 2013, 4:00pm-5:30pm**
**2866 East Hall**
**Andreas Blass (Univ. of Michigan)**
*Sacks forcing and ultrafilter preservation*

This is a continuation of my talk of March 21. I'll give a fairly general sufficient condition for an ultrafilter to be preserved by Sacks forcing.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Analysis/Probability Learning Seminar**
**Thursday, April 04, 2013, 4:10pm-6:00pm**
**4096 East Hall**
**Roman Vershynin (UM)**
*Density of eigenvalues of random matrices (after Erdos, Schlein and Yau)*

In a sequence of recent papers, Erdos, Schlein and Yau proved a local semicircle law and a delocalization of eigenvectors for general symmetric random matrices (with iid entries above diagonal). We will work out some techniques that they developed for this purpose. Specifically, I will show how to upper bound the number of eigenvalues in a given small interval with high probability (a "Wegner estimate").

**Theoretical Computer Science**
**Friday, April 05, 2013, 10:30am-11:30am**
**3941 BBB/CSE**
**Aaron Snook (U-M)**
*An Optimal Lower Bound on the Number of Variables for Graph Identification*

In this paper we show that Omega(n) variables are needed for first-order logic with counting to identify graphs on n vertices. The k-variable language with counting is equivalent to the (k-1)-dimensional Weisfeiler-Lehman method. We thus settle a long-standing open problem. Previously it was an open question whether or not 4 variables suffice. Our lower bound remains true over a set of graphs of color class size 4. This contrasts sharply with the fact that 3 variables suffice to identify all graphs of color class size 3, and 2 variables suffice to identify almost all graphs. Our lower bound is optimal up to multiplication by a constant because n variables obviously suffice to identify graphs on n vertices.

**Applied Interdisciplinary Mathematics**
**Friday, April 05, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Denis Zorin (Courant Institute of Mathematical Sciences, New York University)**
*O(N) direct solver for integral equations on 2D domains*

Most commonly used solvers for boundary integral equations are iterative, using FMM-accelerated matrix-vector multiplication. While these methods are efficient in many contexts, examples of problems that can be challenging to iterative methods include Fredholm equations of the first kind, elasticity problems on geometrically complex domains with thin features, and scattering problems near resonances -- problems with relatively poor conditioning. Direct solvers are a promising alternatives in these contexts, as well as in cases when the same equation needs to be solved with different right-hand sides.

We present an efficient direct solver for integral equations, reaching practical O(N) performance for a broad range of problems. The solver is based on a hierarchical compression method previously developed for boundary integral equations on curves. While a direct extension of the method to planar domains has asymptotic cost is O(N^{3/2}), we demonstrate that the method can be reformulated in a way that an additional level of compression is applied to operators involved in the algorithms. All stages of the resulting direct solver have optimal O(N) complexity, as demonstrated by numerical examples and theoretical analysis . The computational examples further demonstrate good practical performance in terms of both speed and memory usage, as compared to existing state-of-the-art direct solvers: for example, even problems involving 10^{7} unknowns can be solved to precision 10^{-10} using a simple Matlab implementation of the algorithm executed on a single core.

This is joint work with E. Corona and P.-G. Martinsson.

**Geometry**
**Friday, April 05, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Gabor Szekelyhidi (Notre Dame)**
*Filtrations and test-configurations*

Test-configurations are certain degenerations of projective manifolds, used in the definition of K-stability, which in turn is related to the existence of special metrics. I will explain how filtrations of the homogeneous coordinate ring of a projective manifold can be thought of as sequences of test-configurations, and that they encode the limiting behavior of these sequences. Such filtrations arise naturally when studying the Calabi flow, or when trying to minimize the Calabi functional. I will also discuss how filtrations can be used to give a strengthening of the notion of K-stability, and why this is desirable.

**Kottwitz Seminar**
**Friday, April 05, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Charles Stibitz (UM)**
*Spectra and Cohomology Theories, part 5*

**Group, Lie and Number Theory**
**Monday, April 08, 2013, 3:00pm-5:00pm**
**4096 East Hall**
**Pierre Debes (Universite Lille 1, France)**
*The Inverse Galois Problem with Local Conditions*

The results that I will present are part of a program, pursued by my students N. Ghazi, F. Legrand and myself, on the Galois extensions E/Q that can be obtained from a Galois extension F/Q(T) by specializing T. Beyond the Galois group of the specialized extensions, we have investigated their local behavior (inertia groups, decomposition groups) at given primes. I will also explain the implications of the results on classical topics from Inverse Galois Theory, like the Regular Inverse Galois Problem, the Noether program, the Beckmann-Black problem, the Grunwald Problem, the Inverse Galois Problem, etc.

**Student Algebraic Geometry**
**Monday, April 08, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Robert Silversmith (UM)**
*Excess Intersections*

I'll start off with a reminder of how the intersection product works on the Chow ring of a (smooth, projective) variety. Computing intersections of subvarieties with this product usually requires verifying some sort of transversality property. In real life, though, subvarieties aren't always transverse. I'll discuss what we can still conclude. For example, the excess intersection formula expresses the intersection of two subvarieties in terms of both their Chow classes and other terms involving their normal bundles.

**Geometry & Physics**
**Monday, April 08, 2013, 4:00pm-6:00pm**
**4088 East Hall**
**Wenxuan Lu (Upenn)**
*Stability Conditions and Mirror Symmetry of K3 Surfaces in Attractor Backgrounds*

We study the space of stability conditions on K3 surfaces from the per- spective of mirror symmetry. It is done in the so called attractor back- grounds (moduli) which are selected by the attractor mechanism for certain black holes. We find certain highly non-generic behaviors of stability walls (a key notion in the study of wall crossings) in the space of stability condi- tions. They correspond via mirror symmetry to some non-generic behaviors of special Lagrangians in an attractor background.

**Student Combinatorics Seminar**
**Monday, April 08, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Elena Yudovina (UM)**
*A character-building way of computing chromatic polynomials*

We will attempt to compute the chromatic polynomial of an N-by-N square grid, or at least what it looks like when N is large. By judicious use of handwaving on the one hand, and representations of the (Temperley-Lieb) algebra of squiggles on the other, we will relate this to the "six-vertex model" (think alternating sign matrices), which can be solved "exactly". Time will hopefully prevent us from having to write down the final answer.

**Analysis/Probability**
**Monday, April 08, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Antti Knowles (Courant Institute)**
*Quantum diffusion and delocalization for random band matrices [Combined with Differential Equations Seminar]*

I give a summary of recent progress in establishing the diffusion approximation for random band matrices. We obtain a rigorous derivation of the diffusion profile in the regime W > N^{4/5}, where W is the band width and N the dimension of the matrix. As a corollary, we prove complete delocalization of the eigenvectors. Our proof is based on a new self-consistent equation for the Green function. Joint work with L. Erdos, H.T. Yau, and J. Yin.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Differential Equations**
**Monday, April 08, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Antti Knowles (Courant Institute )**
*Quantum diffusion and delocalization for random band matrices. COMBINED WITH ANALYSIS/PROBABILITY SEMINAR.*

I give a summary of recent progress in establishing the diffusion approximation for random band matrices. We obtain a rigorous derivation of the diffusion profile in the regime W > N^{4/5}, where W is the band width and N the dimension of the matrix. As a corollary, we prove complete delocalization of the eigenvectors. Our proof is based on a new self-consistent equation for the Green function.
Joint work with L. Erdos, H.T. Yau, and J. Yin.

**Colloquium Series**
**Tuesday, April 09, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Igor Dolgachev (University of Michigan)**
*Algebra, geometry and topology of Cremona groups*

**Student Arithmetic**
**Wednesday, April 10, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Hunter Brooks (UM)**
*TBA*

**Student Commutative Algebra**
**Wednesday, April 10, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Ashley Wheeler (UM)**
*Introduction to Semigroup Rings*

We first discuss the generation of semigroup rings by lattice ideals. Then, we focus on the more special case of affine semigroup rings, where the defining lattice ideals are prime. In the affine case properties of the ring correspond to the geometry of an associated polyhedral cone. The talk is example-heavy with casual mention of the research context for semigroup rings, including toric varieties and rings of invariants.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Student AIM Seminar**
**Wednesday, April 10, 2013, 3:10pm-4:00pm**
**4088 East Hall**
**Richard B. Choroszucha (University of Michigan)**
*Linear Model Order Reduction In Model Predictive Control*

Model order reduction (MOR) is a common task for model-based control design, specifically for those where a copy of the plant model appears explicitly in the resulting controller. This is done to reduce the number of states and thereby the complexity because plant model complexity dictates the controller complexity and robustness. For computationally intensive optimization-based control, such as model predictive control (MPC), MOR is essential to ensure that the controller is implementable on hardware, especially for applications where the computational resources, such as memory and power, are limited and fast sampling is required.

The problem is that most MOR techniques are meant to be applied to a class of model - stable, unstable, passive, dissipative, etc. - without consideration to the control formulation.

This talk will consist of a brief overview of MPC, the techniques and theoretical tools of linear MOR, and then a novel reduction method that accounts for the MPC control formulation.

**Algebraic Geometry**
**Wednesday, April 10, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Paolo Aluffi (FSU)**
*Segre classes of monomial subschemes*

Segre classes are fundamental intersection-theoretic invariants: many problems in enumerative geometry may be reduced to computations of Segre classes, and basic invariants such as Milnor numbers and classes may be expressed in terms of Segre classes. We propose a formula computing the Segre class of an arbitrary monomial subscheme, and prove this formula in several representative cases. The formula is reminiscent of intersection computations in terms of mixed volumes of polytopes and convex bodies as in the classical Bernstein's theorem and more recent work of Kaveh-Khovanskii, Huh, and others.

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, April 10, 2013, 4:00pm-5:00pm**
**3096 East Hall**
**Andrew Zimmer (U Michigan)**
*More on convex divisible sets*

We will finish the discussion of Benoist's results on the dynamics of the geodesic flow of divisible convex sets and on Zariski density of the dividing group.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Analysis/Probability**
**Wednesday, April 10, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Yuliy Baryshnikov (University of Illinois, Urbana-Champaign)**
*Hadwiger's theorem for functions*

Hadwiger's theorem states that continuous valuations on convex sets in Euclidean space that are invariant with respect to Euclidean motions are spanned by Minkowski functionals.

Valuations on functions - functionals satisfying v(f)+v(g)=v(max(f,g))+v(min(f,g)) - are natural generalizations of valuations on sets.

I will explain what are the reasonable classes of functions to serve as the domain of a valuation, and what notions of continuity to deploy to obtain a generalization of Hadwiger's theorem to functions.

**Financial/Actuarial Mathematics**
**Thursday, April 11, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Thaleia Zariphopoulou (Oxford University and UT Austin.)**
*Postponed to Fall*

**Commutative Algebra**
**Thursday, April 11, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Diane Maclagan (University of Warwick)**
*Tropical Commutative Algebra*

Tropical geometry studies ideals and varieties by via associating a polyhedral complex, called the tropical variety. One description of the tropical variety uses a modification of Grobner bases that takes the valuations of the coefficients into account. This variant has many of the good properties of standard Grobner bases, but can lead to much smaller Grobner bases. I will discuss how to compute these Grobner bases, which have been implemented for the p-adic valuation, and indicate what other commutative algebra information can be uncovered from the tropical approach to an ideal.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Differential Equations**
**Thursday, April 11, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Andreas Grotz (Harvard)**
*On the initial value problem for causal variational principles*

We formulate the initial value problem for causal variational principles in the continuous setting on a compact metric space. The existence and uniqueness of solutions is analyzed. The results are illustrated by simple examples.

**Math Club**
**Thursday, April 11, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Hala Shehadeh (Univ. of Michigan)**
*Convexity*

A convex set is a set which contains all line segments connecting any two of its points. This notion of convexity is surprisingly important and it appears in a wide variety of pure and applied topics, especially optimization. I will give examples of convex sets, convex functions and convex functionals and will show how many problems, when viewed in the right set of variables, become convex optimization problems that are easy to solve.

**Algebraic Geometry**
**Thursday, April 11, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**Johannes Nicaise (Leuven)**
*The Kontsevich-Soibelman skeleton of a degeneration of Calabi-Yau varieties*

**Student Analysis**
**Thursday, April 11, 2013, 5:10pm-6:00pm**
**3096 East Hall**
**Jeremy Hoskins (University of Michigan)**
*TBA*

**Theoretical Computer Science**
**Friday, April 12, 2013, 10:00am-11:00am**
**411 West Hall**
**Aram Harrow (MIT)**
*High-degree graphs cannot be used for a quantum PCP*

One variant of the quantum PCP conjecture states that it is QMA-complete to estimate the ground-state energy of a Hamiltonian with n qubits up to an error proportional to the total number of interacting pairs of qubits in the system. Since this generalizes classical 2-CSPs, this problem is at least NP-hard. We prove that the ground-state energy of 2-local Hamiltonians on D-regular graphs can be approximated in NP with additive error inverse-polynomial in D. Thus, if a quantum PCP theorem were to be true, it would need to make use of constant-degree graphs. The proof is based on information-theoretic techniques introduced by Raghavendra and Tan in arXiv:1110.1064.

Similar techniques also yields a PTAS for Hamiltonians on dense hypergraphs, planar graphs and highly expanding graphs. This last result in fact makes use of an application of the Lasserre SDP hierarchy to the quantum Hamiltonian problem, which generalizes its application to classical CSPs.

Based on joint work with Fernando Brandao.

**Applied Interdisciplinary Mathematics**
**Friday, April 12, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Yuan Young (New Jersey Institute of Technology)**
*Nonlinear dynamics of a lipid membrane under a DC field*

Cells are enveloped by a lipid membrane, which is impermeable to ions and acts as a capacitor when an electric field is applied. In this work we present a long-wave model for the nonlinear dynamics of a planar (unsupported) lipid membrane under a DC field. The lipid membrane is modeled as an interface with a constant area. The governing equations for the non-linear long-wave dynamics are derived under different conditions. Analysis on the equilibrium profile shows the existence of multiple equilibrium profiles. Numerical simulations of the nonlinear dynamics illustrate various novel behaviors, and elucidate the importance of charge distribution on the membrane. We will also examine the possible effects of tangential electric field on the membrane dynamics.

This work is a collaboration with Michael Miksis (Northwestern University) and Shravan Veerapaneni (University of Michigan, Ann Arbor).

**Geometry**
**Friday, April 12, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Livio Flaminio (U Lille)**
*Cohomology and equidistribution for Abelian actions on nilmanifolds*

Following Katok we say that the cohomology of the action of a group $P$ on a smooth manifold $M$ is stable if the space of co-boundaries is closed in the smooth topology. A refinement of this is the notion of tame stability, a fundamental property for perturbation theory. We prove that the action of Abelian subgroups of the Heisenberg group $H^{2n+1}$ on compact quotients of $H^{2n+1}$ are tamely stable in all degrees, under a suitable Diophantine condition. As a consequence we derive precise asymptotics for the deviations of ergodic averages for these group actions. This is a work in collaboration with S.~Cosentino (University do Minho, Braga).

**Group, Lie and Number Theory**
**Monday, April 15, 2013, 3:00pm-4:00pm**
**4096 East Hall**
**Jiarui Fei (UC Riverside)**
*Categorical Homotopy from Quivers*

One question puzzled me for long time is "why do we do homological algebras on a `line' -- a linear complex?". If we want to deal with "n-stuff" instead of "bi-stuff", usually linear complexes are not enough. In this talk, I try to convince you that there are many other possibilities. I first quiver interpret the classical simplicial theory - including the cosimplex category, Dold-Kan correspondence, and Hochschild homology - as a certain Q-homotopy theory of type A. For the cyclic and cubical theories, we can proceed analogously. The point is that linear quivers can be replaced by other families of quivers. I will explain how to use representation theory of quivers to construct meaningful new theories. You will see a lot of examples. No knowledge on quiver representation is needed, just some homological algebra. (Joint with the Algebra Seminar.)

**Student Algebraic Geometry**
**Monday, April 15, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Zhixian Zhu (UM)**
*Zariski decomposition*

Zariski decomposition is a useful tool for the study of divisors on surface. In this talk, we will briefly explain several generalizations of Zariski decomposition on higher dimensional varieties.

**Student Combinatorics Seminar**
**Monday, April 15, 2013, 4:00pm-5:00pm**
**3088 East Hall**
**David Benson-Putnins (UM)**
*Quantum Groups - why are they quantum, and what makes them groups?*

Both these questions will be vaguely answered, along with an introduction to how to make your own quantum groups at home.

**Algebraic Geometry**
**Tuesday, April 16, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Richard Thomas (Imperial College)**
*The GÃ¶ttsche conjecture*

I will describe a classical problem going back to 1848 (Steiner, Cayley, Salmon,...) and a solution using simple techniques that one would never have thought of without ideas coming from string theory (Gromov-Witten invariants, BPS states) and modern geometry (the Maulik-Nekrasov-Okounkov-Pandharipande conjecture). In generic families of curves C on a complex surface S, nodal curves - those with the simplest possible singularities - appear in codimension 1. More generally those with d nodes occur in codimension d. In particular a d-dimensional linear family of curves should contain a finite number of such d-nodal curves. The classical problem - at least in the case of S being the projective plane - is to determine this number. The G Ìˆottsche conjecture states that the answer should be topological, given by a universal degree d polynomial in the four numbers (C Â· C), (c1(S) Â· C), (c1(S)2), and c2(S).

This was proved recently by Yu-Jong Tzeng. I will explain a simpler proof which was joint work with Martijn Kool and Vivek Shende. The treatment will be very low-tech; I wonâ€™t assume any prior knowledge. The main tool is Euler characteristics (which I will also explain).

**Financial/Actuarial Mathematics**
**Tuesday, April 16, 2013, 3:00pm-4:00pm**
**1096 East Hall**
**Umut Cetin (London School of Economics)**
*Explicit construction of a dynamic Bessel bridge of dimension 3*

Given a deterministically time-changed Brownian motion Z starting from 1, whose time-change V(t) satisfies V(t) > t for all t > 0, we perform an explicit construction of a process X, adapted to the filtration generated by Z and another independent Brownian motion, which is a Brownian motion in its own filtration and hits zero for the first time at V(T), where T := inf{t>0: Z_t =0}. Our construction relies on a combination of enlargement of filtration and filtering techniques. The resulting process X may be viewed as the analogue of a 3-dimensional Bessel bridge starting from 1 at time 0 and ending at 0 at the random time V(T). We call this a dynamic

Bessel bridge since V(T) is not known in advance. Our study is motivated by insider trading models with default risk, where the insider observes the firm's value continuously on time.

This is a joint work with L. Campi and A. Danilova.

**Colloquium Series**
**Tuesday, April 16, 2013, 3:10pm-4:00pm**
**1360 EH**
**Richard Thomas (Imperial College)**
*Algebraic geometry Spring lectures: The Gottsche conjecture*

I will describe a classical problem going back to 1848 (Steiner, Cayley, Salmon,...) and a solution using simple techniques that one would never have thought of without ideas coming from string theory (Gromov-Witten invariants, BPS states) and modern geometry (the Maulik-Nekrasov-Okounkov-Pandharipande conjecture).

In generic families of curves C on a complex surface S, nodal curves - those with the simplest possible singularities - appear in codimension 1. More generally those with d nodes occur in codimension d. In particular a d-dimensional linear family of curves should contain a finite number of such d-nodal curves. The classical problem - at least in the case of S being the projective plane - is to determine this number. The Gottsche conjecture states that the answer should be topological, given by a universal degree d polynomial in the four numbers C.C, c_1(S).C, c_1(S)^2 and c_2(S).

This was proved recently by Yu-Jong Tzeng. I will explain a simpler proof which was joint work with Martijn Kool and Vivek Shende. The treatment will be very low-tech; I won't assume any prior knowledge. The main tool is Euler characteristics (which I will also explain).

**Colloquium Series**
**Tuesday, April 16, 2013, 4:30pm-5:30pm**
**Forum Hall, Palmer Commons (4th floor)**
**Stephen Smale (Toyota Technological Institute at Chicago)**
*Mathematics of Protein Folding*

Learning methods in recent science are used to create a geometry on spaces of amino acid sequences. This geometry is used to study immunology, in particular in the peptide binding problem. Then these ideas are used to obtain new results in protein folding.

**Student Arithmetic**
**Wednesday, April 17, 2013, 3:00pm-4:00pm**
**3866 East Hall**
**Corey Everlove (UM)**
*Generalized prime numbers and integers*

The positive integers are a multiplicative semigroup generated by the prime numbers. In 1937, Beurling introduced "generalized integers," formed by taking the multiplicative semigroup generated by a sequence of positive real numbers called "generalized primes." What properties does a system of generalized integers have to satisfy in order for the classical Prime Number Theorem to hold? Can we construct a system of generalized integers for which the Prime Number Theorem holds but the Riemann Hypothesis fails? Answering these questions helps us understand which properties of the usual integers are used in the proof of the PNT and which properties will need to be accounted for in order to improve the PNT. I will give a survey of results of Beurling, Diamond, Malliavin, and others. Proofs will be sketched.

**Student Commutative Algebra**
**Wednesday, April 17, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Ashley Wheeler (UM)**
*Introduction to Semigroup Rings II*

We first discuss the generation of semigroup rings by lattice ideals. Then, we focus on the more special case of affine semigroup rings, where the defining lattice ideals are prime. In the affine case properties of the ring correspond to the geometry of an associated polyhedral cone. The talk is example-heavy with casual mention of the research context for semigroup rings, including toric varieties and rings of invariants.

**Geometry & Physics**
**Wednesday, April 17, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Richard Thomas (Imperial College)**
*See(<a href="http://www.math.lsa.umich.edu/~mmustata/Spring.html">Spring Lectures in Algebraic Geometry</a>)*

**Algebraic Geometry**
**Wednesday, April 17, 2013, 4:00pm-6:00pm**
**3088 East Hall**
**Richard Thomas (Imperial College)**
*Stable maps, ideal sheaves and the MNOP conjecture*

I will gently review two moduli spaces of curves in algebraic varieties, their similarities, differences, and a little about how ones obtains invariants from them. (a) Stable maps, or parameterised curves. (b) Subschemes or unparamet

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, April 17, 2013, 4:00pm-6:00pm**
**3096 East Hall**
**Tengren Zhang (U Michigan)**
*Convex real projective structures on surfaces*

Let M be a closed orientable surface of genus g>1. Goldman proved that the deformation space of convex projective structures on M is a cell of dimension 16g-16. Shortly after, Choi and Goldman also proved that this deformation space is in fact the Hitchin component of the space of representations of the fundamental group of M into SL(3,R). I will explain the proof of these two results.

**Analysis/Probability**
**Wednesday, April 17, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Pavel Bleher (IUPUI)**
*Normal matrix model with a cubic potential. The Riemann-Hilbert approach*

We consider the normal matrix model with a cubic potential. We develop the Riemann-Hilbert approach to orthogonal polynomials associated with this model, and we obtain their asymptotic behavior on the complex plane as the degree n of the polynomial goes to infinity.

**Financial/Actuarial Mathematics**
**Thursday, April 18, 2013, 2:50pm-4:00pm**
**1360 East Hall**
**Umut Cetin (London School of Economics)**
*Risk aversion of market makers and asymmetric information*

We analyse the equilibrium impact of market makers' risk aversion on the equilibrium in a speculative market consisting of a risk neutral informed trader and noise traders. The unwillingness of market makers to bear risk causes the informed trader to absorb large shocks in their inventories. The informed trader's optimal strategy is to drive the market price to its fundamental value while disguising her trades as the ones of an uninformed strategic trader. This results in a mean reverting demand, price reversal, and systematic changes in the market depth. We also find that an increase in risk aversion leads to lower market depth, less efficient prices, stronger price reversal and slower convergence to fundamental value. The endogenous value of private information, however, is non-monotonic in risk aversion.<br />
Based on a joint work with A. Danilova.

**Algebraic Geometry**
**Thursday, April 18, 2013, 3:00pm-4:00pm**
**3088 East Hall**
**Richard Thomas (Imperial College)**
*Stable pairs*

I will explain a third moduli space and the corresponding invariants, and some of their advantages over the previous two.

**Topology**
**Thursday, April 18, 2013, 3:00pm-12:00am**
**3866**
**Guillaume Dreyer (Notre Dame)**
*Parametrizing Hitchin components*

**Math Club**
**Thursday, April 18, 2013, 4:00pm-5:00pm**
**Nesbitt Room**
**Charlie Doering (Univ. of Michigan)**
*The Paradox of Enrichment*

Mathematical models in ecology describe the dynamics of interacting populations such as distinct species competing for common resources, predator-prey systems, and more complex systems like food chains and food webs. You might generally expect that higher fertility habitats would be capable of sustaining larger population levels, but some models show that this may not always be so. In certain situations increasing resource levels can lead to dynamical instabilities producing large population variations and, eventually, the extinction of one or more of the species. The lesson? Be careful what you wish for ... more is not always better!

**Differential Equations**
**Thursday, April 18, 2013, 4:00pm-5:00pm**
**4088 East Hall**
**Michael Dabkowski (UMICH Dept. Mathematics )**
*Eventual Regularity for Solutions of Supercritical Active Scalar Equations*

We will develop a method to dualize the class of Holder continuous functions in a way that is advantageous for estimating the estimating $C^{\beta}$ norms of solutions to supercritical active scalar equations. We will then use these estimates along with Gagliardo-Nirenberg type inequalities to prove eventual smoothness of solutions to the after-fore mentioned equations.

**Logic**
**Thursday, April 18, 2013, 4:00pm-5:30pm**
**2866 East Hall**
**Ashwini Aroskar (Univ. of Michigan)**
*Limits, Regularity and Removal for Relational Structures - A Non-standard Approach*

An interesting interplay between graph theory and analysis is the emergence of analytic limits for discrete structures. My work builds on a non-standard approach to such a theory of limits and extends it to general relational structures, unweighted and weighted. Results include the existence of limits, a regularity lemma and a removal lemma. The main tool here is a theory of measures on ultraproduct spaces.

**Analysis/Probability Learning Seminar**
**Thursday, April 18, 2013, 4:10pm-6:00pm**
**4096 East Hall**
**Elisabeth Meckes (Case Western Reserve University)**
*TBA*

**Algebraic Geometry**
**Friday, April 19, 2013, 4:00am-5:00am**
**4088 EH**
**Richard Thomas (Imperial College)**
*BPS invariants*

BPS invariants, conjectured to exist by Gopaukmar-Vafa, would give a 4th (and in many ways superior) way to enumerate curves. I will explain how stable pairs give an approach to them.

**Theoretical Computer Science**
**Friday, April 19, 2013, 10:00am-11:00am**
**411 West Hall**
**Mary Wootters (U-M)**
*What gaussian processes can do for you: applications of probability and geometry in theoretical computer science*

In this expository talk, I'll give an introduction to gaussian processes and how they can be useful in theoretical computer science. In addition to discussing how to use this toolkit, I will highlight some recent applications in TCS, including results in compressed sensing, coding theory, and graph theory.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Applied Interdisciplinary Mathematics**
**Friday, April 19, 2013, 3:00pm-4:00pm**
**1084 East Hall**
**Martin Strauss (University of Michigan)**
*Some open problems in sustainable energy*

The topic of sustainable energy is timely and important, but extremely broad. There are opportunities for researchers of differing backgrounds to make substantial contributions with great potential impact.

In this talk, we survey a few topics of interest to mathematicians and computer scientists. In a "smart" electricity grid, the grid operator can sense and control not only the sources of electrical power, but also the users of electrical power. This results in a huge dynamical system with many agents. How should the operator manage the grid to maintain voltage near nominal levels and keep current and voltage in phase? What if solar and wind energy, which are much less predictable than other sources, contribute substantial power to the grid? How can a grid operator set prices to result in desired behavior? How can we safeguard the privacy and security of residential customers, when customer data is seen by others and when others can flip switches in the customer's home? If time permits, we will also consider issues outside the smart grid.

**Geometry**
**Friday, April 19, 2013, 3:00pm-4:00pm**
**3096 East Hall**
**Karsten Grove (U Notre Dame)**
*Tits Geometry and Positive Curvature*

There is a well known link between (maximal) polar representations and isotropy representations of symmetric spaces provided by Dadok. Moreover, the theory by Tits and Burns-Spatzier provides a link between irreducible symmetric spaces of non-compact type of rank at least three and irreducible topological spherical buildings of rank at least three. We discover and exploit a rich structure of a (connected) chamber system of finite (Coxeter) type M associated with any polar action of cohomogeneity at least two on any simply connected closed positively curved manifold. Although this chamber system is typically not a Tits geometry of type M, we prove that in all cases but one that its universal Tits cover indeed is a building. We construct a topology on this universal cover making it into a topological building in the sense of Burns and Spatzier. Using this structure we classify all polar actions on (simply connected) positively curved manifolds of cohomegeneity at least two.

**Mathematical Biology**
**Monday, April 22, 2013, 12:00pm-1:00pm**
**335 West Hall**
**Joern Davidsen (Complexity Science Group, University of Calgary)**
*Inferring Causal Connections and Functional Networks*

Inferring cause-effect relationships from observations is one of the fundamental challenges in natural sciences and beyond. Due to the technological advances over the last decade, the amount of observations and data available to characterize complex systems and their dynamics has increased substantially, making scientists face this challenge in many different areas. Specific examples of general importance include seismicity as well as nerve cell cultures and even the brain. In this talk, I will discuss new methods from nonlinear sciences and complex network theory to infer causal interactions and characterize spatio-temporal clustering of point processes with a particular focus on the aforementioned applications. In particular, I will present a method that identifies triggering relationships between earthquakes such that seismicity can be described by triggering cascades and mapped to a complex network. This novel approach allows one to tackle many open questions related to earthquakes and seismicity.

**Student Algebraic Geometry**
**Monday, April 22, 2013, 3:00pm-4:00pm**
**4088 East Hall**
**Xiaolei Zhao (UM)**
*Dual cone of pseudo-effective divisor cone*

We will introduce a result of Boucksom-Demailly-Peternell-Paun describing the dual cone of pseudo-effective divisor cone. As a corollary, a numerical criteria of uniruled varieties will be proved. Then we will prove the BDPP result using an orthogonal property of Fujita approximation.

**Several Complex Variables**
**Monday, April 22, 2013, 4:00pm-5:00pm**
**3096 East Hall**
**Kenneth Koenig (Ohio State)**
*Maximal hypoellipticity for the $\overline{\partial}$-Neumann problem*

We establish maximal hypoellipticity (in $L^p$-Sobolev and Lipschitz norms) for the $\overline{\partial}$-Neumann problem on smooth, bounded pseudoconvex domains in $\mathbb{C} ^n$ under the weakest possible condition on the Levi form. In particular, maximal hypoellipticity holds on the level of $(n-1)$-forms for all smooth, bounded pseudoconvex domains of finite commutator type. These results are new in dimensions $n \ge 3$.

**Analysis/Probability**
**Monday, April 22, 2013, 4:00pm-5:00pm**
**3866 EH (Special date!)**
**Dong Wang (National University of Singapore)**
*Non-intersecting Brownian motions on the circle and discrete Gaussian orthogonal polynomials*

I will discuss the relation between the non-intersecting Brownian motions on a circle, where n particles start from a common point and end at a common point after a time, and the discrete Gaussian orthogonal polynomials, i.e., discrete orthogonal polynomials with respect to the weight exp(-x^2). I will show that as the number of particles goes to infinity, the asymptotics of the discrete Gaussian orthogonal polynomials give rise to the asymptotic behaviours of the non-intersecting Brownian motions, such as the limiting Sine process, Airy process etc. This is joint work with Karl Liechty.

**Group, Lie and Number Theory**
**Monday, April 22, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Hunter Brooks (UM)**
*Generalized Heegner cycles, Shimura curves, and special values of p-adic L-functions*

The Gross-Zagier formula relates special values of the derivative of a Rankin-Selberg L-function to heights of "Heegner points" on elliptic curves. The existence of these points requires an arithmetic assumption (the "Heegner hypothesis"), but Zhang established an analogue with this assumption dropped. The geometric object of interest in Zhang's work is a compact quotient of the upper half plane called a Shimura curve. We give a p-adic formula which relates a p-adic logarithm of a Heegner cycle on a variety fibered over a Shimura curve to special values of a p-adic L-function, removing the Heegner hypothesis from work of Bertolini, Darmon, and Prasanna over modular curves. This formula follows from a "q-expansion-free" approach to p-adic modular forms coming from the deformation theory of ordinary abelian varieties in characteristic p.

**What is... ?**
**Tuesday, April 23, 2013, 2:10pm-3:00pm**
**3866 East Hall**
**Bill Fulton (Univ of Michigan)**
*What is ... a bad math talk?*

This talk -- aimed at young mathematicians, and hoping for audience participation -- will attempt to describe what it takes to make a mathematics talk bad. We will sketch the history of bad mathematics talks, including the great progress that has been made possible in recent decades. We will also discuss some of the similarities and differences between giving bad talks and writing bad papers.

**Financial/Actuarial Mathematics**
**Tuesday, April 23, 2013, 3:00pm-4:00pm**
**1360 East Hall**
**Sebastian Jaimungal (University of Toronto)**
*Robust Market Making*

An agent who wishes to make markets by posting limit buy and sell orders is faced with modelling the arrival rate and volume of marker orders which hit/lift their posted orders. No model can capture the true behaviour of the marketâ€™s data generating process (DGP), hence, simplifying assumptions are often made. A natural question then arises: â€œhow can the agent account for the fact that they know their model is inaccurate?â€• i.e., how can uncertainty in the Knightian sense be addressed? In this talk, I formulate the question through a robust optimal control problem in which the agent is ambiguity averse to Poisson random measures. Specifically, the agent considers a reference measure (representing the simplified model) and all equivalent measures (representing candidate models) and penalizes them according to a quasi relative entropy. Surprisingly, the robust control problem can be reduced to solving a coupled non-linear system of ODEs, which in certain limiting cases can be solved exactly. The optimal postings show that the agent protects themselves from ambiguity in distinct ways depending from where the ambiguity stems. Interestingly, in some cases, the agent behaves as if they have perfect knowledge of the DGP but apply CARA utility; however, in general the ambiguity averse agent cannot be recast as a risk-averse one. Numerical experiments will illustrate several interesting economic insights into the problem.

This is joint work with Ã•lvaro Cartea (University College London) and Ryan Donnelly (University of Toronto)

**Colloquium Series**
**Tuesday, April 23, 2013, 4:10pm-5:00pm**
**1360 East Hall**
**Andreas Blass (Univ of Michigan)**
*The Continuum Hypothesis and Its Enemies*

Cantor's continuum hypothesis (CH) has consequences in many parts of mathematics. I'll give a few examples, but most of the talk will be about what can happen if CH is false. By itself, the negation of CH is not very useful, but set theorists have studied more specific principles that contradict CH. I'll describe some of these principles, indicate where they come from, and exhibit some of their consequences.

**Student Commutative Algebra**
**Wednesday, April 24, 2013, 3:00pm-4:00pm**
**2866 East Hall**
**Angelica Benito (UM)**
*Test ideals in quotients of F-finite regular local rings*

In this talk we continue discussing some facts about F-purity and test ideals, we will start with an overview of the basic definitions we have worked with during the semester and then we will discussed Vassilev's ideas. There she proved that one can construct a filtration of test ideals (in the quotient) with some good properties. We will finish the talk showing some examples that are presented in Vassilev's paper.

**RTG Working Seminar on Geometry, Dynamics and Topology**
**Wednesday, April 24, 2013, 4:00pm-6:00pm**
**3096 East Hall**
**Tengren Zhang (U Michigan)**
*More on convex projective structures on surfaces*

I will continue where I left off last week and explain the proof of a theorem by Choi and Goldman: If M is a closed orientable surface of genus g>1, the deformation space of convex real projective structures on M is the Hitchin component of the space of representations of the fundamental group of M into SL(3,R).

**Analysis/Probability**
**Wednesday, April 24, 2013, 4:10pm-5:00pm**
**4096 East Hall**
**Hoi Nguyen (Yale University)**
*Random matrix: Law of the determinant*

Let M_n be a random matrix with iid entries with mean zero and variance one.
The determinant det M_n is an important parameter and has been studied for a long time.
In this talk, we focus on the limiting distribution and prove that the logarithm of |det M_n| satisfies a central limit theorem. For simplicity, we will mainly consider the case when the entries are Bernoulli random variables; the proof extends easily to the general case.

**Financial/Actuarial Mathematics**
**Tuesday, April 30, 2013, 1:30am-3:30am**
**1096 East Hall**
**Yu-Jui Huang (UM)**
*Thesis Defense: Topics in Stochastic Control with Applications to Finance*

This thesis is devoted to PDE characterization for stochastic control problems when the classical methodology of dynamic programming does not work. Under the framework of viscosity solutions, a dynamic programming principle (DPP) serves as the tool to associate a (nonlinear) PDE to a stochastic control problem. Unfortunately, a DPP is in general difficult to prove, and may fail to be true in some cases. In this thesis, we investigate three different scenarios where classical dynamic programming does not work. The first one is quantile hedging in the presence of arbitrage, the second one is robust growth-optimal trading, and the third one is a stochastic differential game of control and stopping. In each of the cases, we propose methods to circumvent the lack of a classical DPP.

**Theoretical Computer Science**
**Wednesday, May 01, 2013, 12:00pm-1:00pm**
**4941 BBB/CSE**
**Valerie King (University of Victoria)**
*Dynamic Graph Connectivity in Polylogarithmic Worst Case Time*

The dynamic graph connectivity problem is the following: given a graph on a fixed set of n nodes, design a data structure to process an online sequence of updates in the form of edge insertions and deletions, and queries of the form q(a,b): "Is there a path between nodes a and b?" While data structures for this problem with polylogarithmic *amortized* time per operation have been known since the mid-1990's, these data structures have Theta(n) worst case time. In fact, no previously known solution has worst case time per operation which is o(sqrt n).

In this talk I'll explain a solution with worst case times O(log^4 n) per edge insertion, O(log^5 n) per edge deletion, and O(log n/loglog n) per query. The answer to each query is correct if the answer is "yes" and is correct with high probability if the answer is "no." The data structure is based on a simple novel idea which can be used to quickly identify an edge in a cutset.

This work is joint with Bruce Kapron and Ben Mountjoy.

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Theoretical Computer Science**
**Friday, May 03, 2013, 10:30am-11:30am**
**3941 BBB/CSE**
**Jared Saia (University of New Mexico)**
*Byzantine Agreement in Polynomial Expected Time*

How can we build a reliable system out of unreliable parts? Byzantine agreement is fundamental to addressing this question. The Byzantine agreement problem is to devise an algorithm so that n agents, each with a private input can agree on a single common output that is equal to some agent's input. In the classic Byzantine agreement problem, communication is via asynchronous message-passing and the adversary is adaptive with full information. In particular, the adversary can adaptively determine which processors to corrupt and what strategy these processors should use as the algorithm proceeds; the scheduling of the delivery of messages is set by the adversary, so that the delays are unpredictable to the algorithm; and the adversary knows the states of all processors at any time, and is assumed to be computationally unbounded. Such an adversary is also known as strong.

We present a polynomial expected time algorithm to solve asynchronous Byzantine Agreement with a strong adversary that controls up to a constant fraction of the processors. This is the first improvement in running time for this problem since Ben-Or's exponential expected time solution in 1983. Our algorithm is designed so that in order to thwart it, corrupted agents must engage in statistically deviant behavior that is detectable by individual agents. This suggests a new paradigm for secure distributed computing: the design of algorithms that force an attacker into behavior that is statistically deviant in a way that is computationally detectable.

**Algebraic Geometry**
**Thursday, May 16, 2013, 12:00am-12:00am**
**TBA**
**()**
*Conference in Algebraic Geometry*

**Algebraic Geometry**
**Friday, May 17, 2013, 12:00am-12:00am**

**()**
*Conference in Algebraic Geometry*

# Seminar & Events Bulletin: All

**01-01-2013 to 06-30-2013**

**Algebraic Geometry**
**Saturday, May 18, 2013, 12:00am-12:00am**
**3088 East Hall**
**()**
*Conference in Algebraic Geometry*

**Algebraic Geometry**
**Sunday, May 19, 2013, 12:00am-12:00am**
**3088 East Hall**
**()**
*Conference in Algebraic Geometry*

**Analysis/Probability Learning Seminar**
**Thursday, May 23, 2013, 4:10pm-5:20pm**
**4096 East Hall**
**Raja Giryes (Technion, Israel)**
*The analysis cosparse model for signals and images*

The cosparse analysis model has been introduced recently as an interesting alternative to the standard sparse synthesis approach. In this talk I will point to the differences between the two models and the advantages and disadvantages that the analysis framework introduce for signal and image processing. A general recipe for generating analysis algorithms from existing synthesis ones will be presented, together with theoretical guarantees for several such "converted techniques". The impact of these results on the sparse synthesis framework will be discussed as well, highlighting a new view to what seems to be already classical results in sparse approximation theory. I will conclude with some open problems still unanswered.