MATH IS POWER

Department of Mathematics
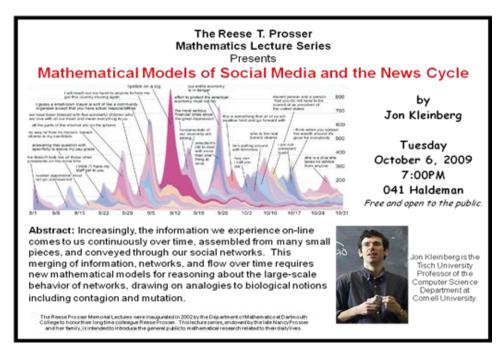## Dartmouth College - Hanover, NH
September 2010

Letter from the Chair, Dan Rockmore

Welcome to the third annual newsletter of the Department of Mathematics. Apologies for the delay! As you will see below, the 2009-2010 year was a busy one and 2010-2011 even busier, so we're a little late. This newsletter is intended to reach out to all members of the Dartmouth College Mathematics Department, including but not limited to: current department members, past faculty, graduate alumni and undergraduate math majors/minors alumni.

The department had a very productive year. Highlights include several new research grants, many more publications, some media attention, and also another great surge in campus presence in the sense of another increase in math class enrollments (by over 10%) and a 2010 class of 40 majors, 4 senior theses, and finally, a spectacularly busy summer of 2010 as we hosted the **International Conference on Spectral Geometry** in July and the **Eighth Conference on Permutation Patterns** in August, each of which had over 70 participants from around the world. We then hosted the **East Coast Operator Algebra Symposium** in October (but more on these meetings in the **next** newsletter – information on these conferences can be found at http://www.math.dartmouth.edu/activities/conferences/). Below are the posters from last year's Reese T. Prosser Lecture that is scheduled every fall and the Kemeny Public Lecture (and Lecture Series) that is scheduled every spring. More information on these events can be found at: http://www.math.dartmouth.edu/activities/. These activities (and others) are supported by generous contributions from various friends and alumni of the department. Directed gifts like these help make the department among the most vibrant on campus.

[2010 Kemeny Undergraduate Lecture]

[2009 Reese T. Prosser Lecture Series]

We hope you enjoy the newsletter. We are still working on an alumni section for next year, for you to share any updates (professional or personal) or news. If you know of any other alumni or others who might enjoy our newsletter please email **Stephanie Kvam** (stephanie.kvam@dartmouth.edu). We also encourage you to think of us for job postings! Please keep in touch and visit our webpage (www.math.dartmouth.edu) for more information.

With best regards and best wishes,

Dan Rockmore
John G. Kemeny Parents Professor of Mathematics
Chair, Department of Mathematics

Faculty Highlights

Alex Barnett was invited to give talks at Frontiers in Computational and Applied Mathematics, NJIT, in Newark, NJ (May 2010); Numerical solution of the Painleve equations, ICMS, Edinburgh, UK (May 2010); Applied Analysis Seminar, Louisiana State University (March 2009); Dartmouth Math Colloquium (November 2009); MIT Applied Math Colloquium (November 2009); Computational Optical Sensing and Imaging Seminar, CU Boulder (September 2009); and Topological Complexity of Random Sets, AIM workshop, Palo Alto (August 2009). Finally, he and L. Greengard gave a talk on "Accurate and robust computation of photonic crystal band structure using second-kind integral equations" at the 9th International Conference on Mathematical and Numerical Aspects of Waves Propagation in Pau, France (June 2009).

Vladimir Chernov gave several talks this past year including: "Topological Properties of Manifolds admitting a Y^x-Riemannian metric" at the Analysis seminar of the Department of Mathematics, University of Western Ontario, Canada (January 2010); and "Legendrian links, causality, and the Low conjecture" which was given at the Department of Mathematics Colloquium, University of Western Ontario, Canada (January 2010), the special session on Geometry and Topology of the 2009 Fall Southeastern AMS Sectional #1053 Meeting held in Boca Raton, Florida (October-November 2009), the seminar "Mnogoobraziya i ih otobrazheniya" ("Manifolds and their mappings") at the Mechanics and Mathematics Department of the Moscow State University, Moscow, Russia (September 2009), and the D. Sokolov seminar "Cosmic electrodynamics and dynamo theory" at the "Research Computing Center" of the Moscow State University, Moscow, Russia (September 2009).

Sergi Elizalde gave presentations at the following conferences: a conference in Honor of Doron Zeilberger's 60th Birthday, Rutgers University, (May 2010); Howard University Mathematics Colloquium (May 2010); JHU Center for Talented Youth, Keynote address (May 2010); LaCIM Seminaire, UQAM (April 2010); MIT Combinatorics Seminar (March 2010); Rutgers University Experimental Mathematics Seminar (February 2010); Dartmouth College Combinatorics Seminar (January 2010); AMS Fall Southeas-

tern Meeting (invited) (October 2009); AMS Fall Eastern Section Meeting (invited) (October 2009); University of Hawaii Mathematics Colloquium (October 2009); 23rd Midwest Conference on Combinatorics, Cryptography, and Computing (invited) (October 2009); International conference on Formal Power Series and Algebraic Combinatorics, FPSAC (2009); International conference on Permutation Patterns, PP (2009).

Carolyn Gordon served as a co-organizer of a Special Session on "Inverse spectral problems in geometry and analysis" at Joint Annual Math Meetings, Jan. 2010. She gave the Noether Lecture at the Joint Mathematics Meetings, "You can't hear the shape of a manifold" (Jan. 2010). She was also invited to give talks at the following conferences: International Conference on Geometry and Spectral Theory, University of Grenoble, (June 2009); conference on Spectral Geometry and Geometric Analysis (July 2009); Young Mathematicians Conference (August 2009); Texas Geometry and Topology Conference (Feb. 2010).

Marcia Groszek served as a Visiting Scholar at the University of California at Berkeley (October-November 2009).

Rosa Orellana gave the following conference presentations and invited addresses over the past year: Eastern Section Meeting of the AMS, section on algebraic combinatorics in University Park, Pennsylvania (October 2009); Mathematical Foundations of Quantum Information Conference and workshop in Seville, Spain (November 2009); Combinatorics Seminar, Dartmouth College (January 2010); Combinatorics Seminar, Massachusetts Institute of Technology (MIT) (February 2010); Graduate Recruiting Open House, Dartmouth College (March 2010); and the Central Section Meeting of the AMS, section on Hecke Algebras and Deformations in Geometry and Topology at Macalester College in St. Paul, Minnesota (April 2010).

Scott Pauls was invited to speak at the AMS Special Session in Lexington, KY (March 26-28, 2010) and the Summer School on Complex Systems at the Sante Fe Institute (June 2009).

Carl Pomerance gave numerous talks over the past academic year including: "A 1935 paper of Paul Erdös

on prime numbers and Euler's function," University of Montreal (July 2009) and as a plenary lecture at the 41st Southeastern Conference on Combinatorics, Graph Theory and Computing in Boca Raton, FL (March 2010); "Counting fields," U. C. Berkley Number Theory Seminar (February 2010) and Stanford U. Analytic Number Theory Seminar (March 2010); "φ, λ, σ," West Coast Number Theory Conference (December 2009); "Discrete Logarithms," Dartmouth Number Theory Seminar (November 2009); "Fixed points for discrete logariths," plenary lecture, 41st Southeastern Conference on Combinatorics, Graph Theory and Computing; "The Pólya-Vinogradov inequality," Illinois Number Theory Conference in honor of Harold Diamond (May 2010); and "Fibonacci integers," Banff Conference in honor of Cam Stewart (May-June 2010).

Craig Sutton started the year by giving a plenary talk at the Conference on Geometric Spectral Theory at the Universite de Neuchatel (Switzerland) in the summer of 2009. In January 2010, Sutton was a co-organizer of the special session "Spectral problems on compact Riemannian manifolds" at the Joint Meetings of AMS & MAA. In March 2010, Craig visited Michigan State University, where he gave a couple of talks on inverse spectral geometry. Finally, in the spring of 2010 Sutton had the great pleasure of watching his student, Seunghee Ye, defend his senior thesis entitled "Isospectral surfaces with distinct covering spectra." It was an excellent presentation and the highpoint of Craig's academic year.

Jody Trout gave the talk "On the Nonexistence of Nontrivial Involutive n-Homomorphisms of C*-algebras" at the New Hampshire Operator Theory Symposium, UNH (October 2009).

Vince Vatter leaves his JWY position this summer to advance his career as an Assistant Professor (tenure-track) in Mathematics at the University of Florida – Gainsville. We wish him all the best in his new job!

Rebecca Weber gave a variety of talks over the past year: "The 5 W's of computability theory" given at the Dartmouth College Graduate Open House (March 2010); "Degree invariance in the $\prod_1^0$ classes," invited address at the Association for Symbolic Logic Annual Meeting, George Washington University (March 2010); "What is computability theory?" University of Richmond Mathematics Colloquium (March 2010);

"Reals that are low for information," Southeastern Logic Symposium, University of Florida, Gainesville (February 2010); "Mutual information," Notre Dame Logic Seminar (December 2009); "Mutual information," Madison Logic Seminar, University of Wisconsin (November 2009); "Patterns and definability," 5-talk series, Notre Dame Working Seminar (October 2009); "Degree invariance in the $\prod_1^0$ classes," Midwest Computability Seminar, University of Chicago (September 2009).

Dana Williams served as a visiting scholar at the University of new South Wales in Sydney, Australia (November 2009).

In April 2010, **Peter Winkler** gave the prestigious Simons Lectures at MIT.

Publications

Arkowitz, Martino and Dae-Wong Lee. "Properties of Comultiplications on a Wedge of Spheres." Topology and its Applications, vol. 157 (2010): 1607-1627.

Barnett, A. and T. Betcke (University College, London, UK). A MATLAB toolbox to solve Helmholtz PDE problems with particular and fundamental solution methods, version 1.0 released Sept 2009 (tutorial 31 pages, manual 37 pages). <http://code.google.com/p/mpspack>

Barnett, A. H. and T. Betcke. "An exponentially convergent nonpolynomial finite element method for time-harmonic scattering from polygons." SIAM J. Sci. Comp. 32 (3), (2010): 1417–1441.

Barnett, A. and L. Greengard. "A new integral representation for quasiperiodic fields and its application to two-dimensional band structure Calculations." Submitted, J. Comput. Phys, (Jan 2010): 23 pages.

Barnett, A. H., L. Polansky, and M. Winter "A few more words about James Tenney: dissonant counterpoint and statistical feedback." In press, J. Math. Music (submitted Oct 2009).

Chernov, V. and S. Nemirovski. "Legendrian links, causality and the Low conjecture." Geom. Funct. Anal. 19 (2010): 1320-1333.

Chernov, V. and S. Nemirovski. "Non-negative Legnedrian isotopy in St*M." <u>Geometry and Tolpology</u> 14 (2010): 611-626.

Elizalde, S. "Improved bounds on the number of numerical semigroups of a given genus." <u>J. Pure Appl. Algebra</u> 214 (2010): 1862-1873.

Elizalde, S. "The number of permutations realized by a shift." <u>SIAM J. Discrete Math.</u> 23 (2009): 765-786.

Elizalde, S. "Permutations realized by shifts." <u>Discrete Math. Theor. Comput. Sci.</u> proc. AK (2010): 361-372.

Elizalde, S. "The X-class and almost-increasing permutations." <u>Ann. Comb.</u>, to appear.

Gordon, C. "Sunada's isospectrality tehcnique: two decades later." Proceedings of the Conference "Spectral Analysis in Number Theory and Geometry on the occasion of Toshikazu Sunada's 60th birthday." <u>Contemp. Math.</u> 484 (2009): 45-58.

Gordon, C., J. Tirao, J. Vargas, and J. A. Wolf. Edited volume "New developments in Lie theory and geometry." <u>Contemporary Math.</u> 491 (2009), Amer. Math. Soc., Providence, RI.

Andersen, Brooke and **Marcia Groszek**. "Grigorieff Forcing on Uncountable Cardinals Does Not Add a Generic of Minimal Degree." <u>Notre Dame Journal of Formal Logic</u> 50 (2009), no. 2: 195-200.

Corduan, Jared, **Marcia Groszek**, and Joseph Mileti. "Reverse Mathematics and Ramsey's Property for Trees." <u>J. Symbolic Logic</u> 75 (2010), No. 3: 945-954.

Briand, E., **R. Orellana**, and M. Rosas. "Quasipolynomial formulas for the Kronecker coefficient indexed by two-row shapes (extended abstract)." 21st International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC 2009), 241-252, <u>Discrete Mathematics and Theoretical Computer Science Proc.</u>, *AK. Nancy 2009.* <<http://arxiv.org/abs/0812.0861>>

Briand, E., **R. Orellana**, and M. Rosas. "Reduced Kronecker coefficients and a counterexample to Mulmuley's strong saturation conjecture SH." With an appendix by Ketan Mulmuley. <u>Computational Com-</u>plexity 18 (2009), no. 4: 577-600. <<http://arxiv.org/abs/0810.3163>>

Capogna, L., **S. Pauls**, and J. Tyson. "Convexity in Carnot groups and the horizontal second fundamental form." <u>Trans. Amer. Math. Soc.</u> 362 (2010): 4045-4062.

Danielli, D., N. Garofalo, D. M. Nhieu, and **S. Pauls**. "The Bernstein Problem for Embedded Surfaces in the Heisenberg Group." <u>Indiana University Journal of Mathematics</u> 59 (2010): 563-594.

Danielli, D., N. Garofalo, D. M. Nhieu, and **S. Pauls**. "Instability of graphical strips and a positive answer to the Bernstein problem in the Heisenberg group." <u>J. Diff. Geom.</u> 81:2 (2009): 251-296.

Pauls, S. "Cortical Feature maps via Geometric models." <u>J. Physiology</u> (Paris), 103 (2009): 46-51.

Hladky, R. and **S. Pauls**. "Minimal surfaces in the Roto-translation group with applications to a neurobiological image completion model." <u>J. Math. Imaging and Vision</u> 36:1 (2010): 1-34.

Banks, W. D., C. W. Nevans, and **C. Pomerance**. "A remark on Giuga's conjecture and Lehmer's totient problem." <u>Albanian J. Math.</u> 3 (2009): 81–85.

Belabas, K., M. Bhargava, and **C. Pomerance**. "Error estimates for the Davenport–Heilbronn theorems." <u>Duke Math. J.</u> 153 (2010): 173–210.

Kobayashi, M., P. Pollack, and **C. Pomerance**. "On the distribution of sociable numbers." <u>J. Number Theory</u> 129 (2009): 1990–2009.

Levin, M., **C. Pomerance**, and K. Soundararajan. "Fixed points for discrete logarithms." ANTS IX Proceedings, LNCS 6197 (2010): 6–15.

Li, S. and **C. Pomerance**. "On the Artin-Carmichael primitive root problem on average." <u>Mathematika</u> 55 (2009): 167–176.

Luca, F. and **C. Pomerance**. "On the radical of a perfect number." <u>New York Journal of Math.</u> 16 (2010): 23–30.

Pomerance, C. "Primality testing: variations on a theme of Lucas." In the Proceedings of the 13th Meeting of the Fibonacci Association, Congressus Numerantium 201 (2010): 301–312.

Pomerance, C. and I. E. Shparlinski. "Rank statistics for a family of elliptic curves over a function field." Pure Appl. Math. Q. 6 (2010): 21–40.

Chirikjian, G., G. Leibon, **D. Rockmore**, and W. Park. "Accurate image rotation using Hermite expansions." IEEE Transactions on Image Processing 18(9) 2009: 1988–2003.

Chirikjian, G., D. Madden, W. Park, and **D. Rockmore**. "Deblurring of motionally averaged images with applications to single-particle cryo-electron microscopy." arXiv: 0710.0690, Inverse Problems, Volume 26, Number 3, March 2010 doi: 10.1088/0266-5611/26/3/035002.

Genovese, G., G. Leibon, M.Pollak, and **D. Rockmore**. "Improved IBD detection using incomplete haplotype information." BMC Genetics, Volume 11:58 (2010).

Graham, D., J. Hughes, and **D. Rockmore**. "Quantification of artistic style through sparse coding analysis in the drawings of Pieter Bruegel the Elder." Proceedings of the National Academy of Sciences USA, vol. 107, no. 4, (2010): 1279–1283.

Graham, D. and **D. Rockmore**. "The packet-switching brain." J. of Cognitive Neuroscience, Early Access Posted Online March 29, 2010. (doi:10.1162/jocn.2010.21477).

Krakauer, D. C., J. C. Flack, S. Dedeo, D. Farmer, and **D. Rockmore**. "Intelligent data analysis of intelligent systems." Advances in Intelligent Data Analysis IX (2010) 6065: 8-17.

Malandro, M. and **D. Rockmore**. "Fast Fourier transforms for the rook monoid" Transactions of the AMS 362(2) 2010: 1009 – 1045.

Shemanske, T. "Constructing Simultaneous Hecke Eigenforms, International J of Number Theory, 6 (5), 2010, 1117-1137.

Shemanske, T. "Split Orders and Convex Polytopes in Buildings." J. of Number Theory 130 (2010) 101-115.

Gornet, R., B. De Smit, and **C. J. Sutton**. "Sunada's method and the covering spectrum." J. Differential Geom., 37 pages.

Sutton, C. J. "Equivariant isospectrality and Sunada's method." Arch. Math. (Basel), 11 pages.

Barmpalias, George, Doug Cenzer, Jeff Remmel, and **Rebecca Weber**. "K-triviality of closed sets and continuous functions." Journal of Logic and Computation 1(2009): 3–16.

Cenzer, Doug, Takayuki Kihara, **Rebecca Weber** and Guohua Wu. "Immunity and non-cupping for closed sets." Tbilisi Mathematical Journal, 2(2009): 77–94.

Cenzer, Doug, **Rebecca Weber**, and Guohua Wu. "Immunity of closed sets." Mathematical Theory and Computational Practice (CIE 2009), eds. K. Ambos-Spies, B. Loewe and W. Merkle, Springer Lecture Notes in Computer Science 5635(2009): 109–117.

an Huef, Astrid, Steven Kaliszewski, Iain Raeburn, and **Dana P. Williams**. "Extension problems for representations of crossed product C*-algebras." J. Operator Theory 62 (2009): 171-198.

Ionescu, Marius and **Dana P. Williams**. "Irreducible representations of groupoid C*-algebras." Proc. Amer. Math. Soc. 137 (2009): 1323-1332.

Ionescu, Marius and **Dana P. Williams**. "The generalized Effros-Hahn conjecture for groupoids." Indiana Univ. Math. J. (2009): 2489-2508.

Brightwell, G. R. and **P. Winkler**. "Submodular percolation." SIAM J. Disc. Math. 23 #3 (2009): 1149–1178.

Kenyon, R. and **P. Winkler**. "Branched polymers." Amer. Math. Monthly 116 #7 (Aug-Sept 2009): 612–628.

Paterson, M., Y. Peres, M. Thorup, **P. Winkler,** and U. Zwick. "Maximum overhang." Amer. Math. Monthly 116 #9 (Nov 2009): 763–787.

Winkler, P. <u>Bridge at the Enigma Club.</u> Toronto, ON: Masterpoint Press, 2010.

Elizalde, S. and **P. Winkler**. "Sorting by Placement and Shift." Proceedings of the Twentieth Annual ACM-SIAM Symposium on Discrete Algorithms, SODA 2009.

Gordon, C., W. Kirwin, D. Schueth, and **D. Webb**. "Quantum Equivalent Magnetic Fields that are not classically equivalent." Submitted to <u>Ann. Inst. Fourier</u>, Grenoble.

Gordon, C., D. Schueth, and **C. Sutton**. "Local Rigidity of Bi-invariant Metrics on Compact Lie Groups." <u>Ann. Inst. Fourier</u>, Grenoble 60 (2010): 1617-1628.

Gordon, C. and **C. Sutton**. "Local Rigidity of Naturally Reductive Metrics on Simple Lie Groups." To appear in <u>Math Zeitschrift</u>.

Grants/Research

Alex Barnett received the Class of 1962 Faculty Fellowship, Dartmouth College, Winter 2010. He also received a grant from National Science Foundation for "Efficient spectrally accurate global basis methods for high frequency wave scattering, eigenmodes, and photonics," PI, 2008-2011.

Sergi Elizalde received an Individual Grant from the National Science Foundation, Pattern avoidance in dynamical systems, Program in Algebra, Number Theory and Combinatorics, PI, 2010-2013; a National Science Foundation Conference Grant to organize Permutation Patterns 2010, PI; and a Junior Faculty Fellowship, Dartmouth College, 2010-2011.

Carl Pomerance received a grant from the National Science Foundation, DMS-0703850, PI, 2007-2010. He also received a supplement to this grant to support an additional graduate student for the 2009-2010 academic year.

Dan Rockmore received several grants including a grant from the Sloan Foundation, "Network Models of Systemic Risk," PI, 2010–2012; a grant from NSF ISE "Pushing the Limits: Building Capacity to Enhance Public Understanding of Math and Science Through Rural Libraries," PI, 2010–2014; and a grant from the Kress Foundation, "The Workshop Practices of Botticelli before Rome: Collaboration with Filippino Lippi in 'The Story of Esther,'" PI, 2010–2011.

Rebecca Weber received an award from the National Science Foundation Focused Research Group in Algorithmic Randomness, co-PI, July 2007–June 2010. She also received the Junior Faculty Fellowship, Fall 2009 (additional non-resident term).

Dana Williams, PI, **Erik van Erp**, Co-PI, **and Jody Trout**, Co-PI, received a grant from the NSF for the Eighth East Coast Operator Algebras Symposium (ECOAS), DMS-1000499, Jan-Dec 2010.

Colloquia, Seminars, and Meetings

The 2009-2010 Kemeny Lecture Series in February featured **Persi Diaconis**, Mary V. Sunseri Professor of Statistics and Mathematics at Stanford University. Professor Diaconis presented three lectures: "The Search for Randomness," "Adding Numbers, Shuffling Cards and an Amazing Matrix," and "On Adding a List of Numbers (and other one dependent determinantal processes)." To view past and future Kemeny Lectures go to:
https://www.math.dartmouth.edu/activities/kemeny-lectures/

The 2009-2010 **Reese Prosser Memorial Lecture** in October featured **Jon Kleinberg**, Tisch University Professor of the Computer Science Department at Cornell University. Professor Kleinberg lectured on: "Mathematical Models of Social Median and the News Cycle." To view past and future Prosser Lectures go to:
https://www.math.dartmouth.edu/activities/prosser-lectures/

Colloquia are held on most Thursdays during the Fall, Winter and Spring Terms. Department Seminars are held weekly. Visit the Math webpage to view the calendar, for more specific information click on the *Activities* tab.

The Fall 2009 Colloquia talks were:

- **David Ben McReynolds**, University of Chicago "Bertrand's Postulate and Subgroup Growth"
- **John Voight**, University of Vermont "Huge Rings of low rank with a standard involution and quaternion rings"
- **Rasul Shafikov**, University of Western Ontario "Uniformization of domains in complex manifolds"
- **David Johnson**, AT&T Labs "Bin Packing: From Theory to Experiment and Back Again"
- **Chris Danforth**, University of Vermont "Forecasting Chaotic Physical Processes"
- **Yuliy Baryshnikov**, Bell Labs "Caging and Linking"
- **Tom Tucker**, University of Rochester "Dynamical Mordell--Lang problems"
- **Alex Barnett**, Dartmouth "High-accuracy computation of photonic crystal bands and scattering of waves from polygons"
- **Dmitry Jakobson**, McGill University "Estimates from below: spectral function, remainder in Weyl's law and resonances"
- **Colva Roney-Dougal**, University of St. Andrews "Primitive groups and maximal subgroups"

The Winter 2010 Colloquia talks were:

- **Aidan Sims**, University of Wollongong "Product systems and topological higher-rank graphs"
- **Laurent Demanet**, Massachusetts Institute of Technology "The butterfly algorithm and some of its applications"
- **Moon Duchin**, University of Michigan "Geodesic currents and the geometry of surfaces"
- **Sami Assaf**, Massachusetts Institute of Technology "Schur positivity"
- **Ben Schmidt**, University of Michigan "Blocking Light in Riemannian manifolds"
- **Scott Carter**, University of South Alabama "Quandles: An introduction and applications"
- **Jorge Lauret**, UC Berkeley - Universidad Nacional de Córdoba (Argentina) "Homogeneous Ricci flows and solitons"
- **Jack S. Calcut**, Michigan State University "Artin Presentations: a new theory of smooth 4-manifolds with applications to modern physics"

The Spring 2010 Colloquia talks were:

- **Paul Pollack**, University of Illinois at Urbana-Champaign "Two thousand years of summing divisors"
- **Florian Luca**, UNAM "Phi and Sigma: From Euler to Erdos"
- **John Quigg**, Arizona State University "Topological graphs and principal bundles"
- **Hugo Parlier**, University of Toronto "Surfaces of large genus"
- **Lillian Pierce**, Princeton "Discrete Analogues in Harmonic Analysis"
- **Greg Martin**, University of British Columbia "Prime number races"
- **Stephanie van Willigenburg**, University of British Columbia "Quasisymmetric refinements of Schur functions"
- **Charles Epstein**, Penn "A New Approach to the Numerical Solution of Maxwell's Equations"
- **Jeff Strom**, Western Michigan University "What is so special about spheres?"
- **Maxim Braverman**, Northeastern University "Background cohomology of non-compact Kahler manifolds"

Shapiro Visitors

The Shapiro Visitor Program in Mathematics is funded through the generosity of Ed Shapiro (1916-2003), long-time friend and supporter of the Department of Mathematics. Shapiro Visitors for the 2009-2010 academic year were:

- Rosemary Braun (NCI-NIH)
- Graham Brightwell (London School of Economics)
- Robert Brignall (The Open Univeristy)
- Dorin Dumitrascu (University of Arizona)
- Don Hadwin (Univeristy of New Hampshire)
- Marius Ionescu (Colgate University)
- Greg Martin (University of British Columbia)
- Ken-ichi Maruyama (Okayama University)
- Paul Pollack (University of Illinois at Urbana-Champaign)
- John Quigg (Arizona State University)
- Aaron Smith (University of Pennsylvania)
- Jeff Strom (Western Michigan University)

- Miranda Teboh-Ewungkem (Lafayette College)
- Tom Yuster (Lafayette College)

Graduate Student Highlights

Congratulations to our 5 new Ph.D. graduates. **Giulio Genovese** (Dan Rockmore, advisor) has accepted a research position at Beth Israel Ceaconess Medical Center. Giulio's thesis is titled: "On the Importance of Phase in Improving Detection of Shared Genomic Segments." **Paul Kinlaw** (Vladimir Chernov, advisor) has accepted an Assistant Professor position at Husson College in Bangor, ME. Paul's thesis is titled: "Refocusing of Null-Geodesics in Lorentz Manifolds." **Mitsuo Kobayashi** (Carl Pomerance, advisor) has accepted a tenure track position at Cal Poly Pomona in Pomona, CA. Mitsuo's thesis is titled: "On the Density of Abundant Numbers." **Nicholas Scoville** (Martino Arkowitz, advisor) has accepted a tenure track position at Ursinus College in Collegeville, PA. Nicholas' thesis is titled: "A Metric for Homotopy Types." **Sarah Wright** (Dana Williams, advisor) has accepted a visiting professor position at Holy Cross in Worcester, MA. Sarah's thesis is titled: "Aperiodicity in Topological k-Graphs." To read abstracts go to: http://www.math.dartmouth.edu/graduate-students/theses/

Mits Kobayashi gave a talk at AMS Sectional meeting at Penn State.

Ben Linowitz attended a workshop at AIM (American Institute of Mathematics) on Noncongurence Modular Forms and Modularity (Aug 2009).

Paige Rinker was awarded the first annual Kenneth P. Bogart Teaching Award. She served as an active member of the Future Faculty Advisory Board for the Dartmouth Center for the Advancement of Learning. Paige also gave a poster presentation on "Spectral Analysis for Phylogenetic Trees," Neural Image Processing Systems Conference in Whistler, BC (December 2009).

Nick Scoville attended Spring School on Applied and Toric Topology in Malaga, Spain (May 2010).

Lola Thompson gave a talk at the Ross Mathematics Program (a number theory summer camp for high school students) in Columbus, OH (July 2009). Central School.

Enrique Trevino served as a panelist to select problems and grade competition for the IberoAmerican Mathematical Olympiad (a competition consisting of students from Latin American and the Iberia Peninsula), Morelia MX and Queretaro, MA (Aug and Sept 2009). He gave talks at Hartford High School and Tunbridge. Enrique also coached a Mathcounts team for Rivendell Academy in Orford, NH.

Sarah Wright gave a talk at the Great Plains Operators Theory Symposium (GPOTS) in Denver, CO (June 2010). Sarah also attended the West Coast Operator Algebra Symposium in Reno, NV and the East Coast Operator Algebra Symposium at Texas A&M (October 2009).

Mits Kobayashi, **Lola Thompson** and **Enrique Trevino** all gave talks at the Integers Conference in honor of Dartmouth Professor Carl Pomerance. Carrollton, GA (October 2009).

Mits Kobayashi, **Nick Scovile** and **Sarah Wright** gave talks at AMS-MAA joint meetings in San Fransisco, CA (January 2010).

Ben Linowitz and **Lola Thompson** presented their findings at MSRI's SAGE DAYS 22 Workshop in Berkeley, CA (June 2010).

Ben Linowitz, **Lola Thompson** and **Enrique Trevino** gave talks at the Maine-Quebec Number Theory Conference in Orono, ME (October 2009).

In September we welcome 7 incoming students to our Ph.D. Program. **Ian Adelstein** from Swarthmore College, **Jonathan Bloom** from University of California at Berkley, **Megan Ehresmann** from St. Olaf College, **Nathan McNew** from University of Denver, **Jennifer Shellenbarger** from Miami University, **Sarah Wolff** from Colorado College, and **Lin Zhao** from Nankai University.

John Hopkins University Center for Talented Youth Odyssey Series Mathematics Program

On May 1, 2010 Dartmouth College hosted the Odyssey Series Mathematics program for the John Hopkins University Center for Talented Youth (CTY) students and their parents. Around 75 students (grades 7-10) and parents attended this academically enriching experience.

The program was kicked off with the keynote address, presented by Professor **Sergi Elizalde,** "A Sampling of What Mathematicians Do: Some Unsolved Problems about Tilings and Compuations." After that parents and students broke into groups to attend the breakout sessions, run by Dartmouth graduate students: **Page Rinker** and **Lola Thompson** presented, "Patterns in Primes: An Exploration in Number Theory;" **Patricia Cahn**, **Elizabeth Gillaspy**, and **Katie Kinnaird** ran the session, "Which Way is Up: An Exploration in Topology;" and **Zachary Hamaker** and **Enrique Trevino** presented, "Surprising Problems in Combinatorics and Geometry."

Professor **Jody Trout** presented the plenary session in the afternoon, "The Fourth Dimension: History and the Hypercube." The program concluded with tours of Dartmouth campus.

The program was a huge success. Parents and students alike praised the breakout sessions and the talks that were given. Everyone, including the speakers and organizers, had a wonderful time.

Math Majors and Minors

In 2010, 40 Math Majors and 15 Minors graduated. In addition, the following students presented honors theses. To read abstracts go to:
https://www.math.dartmouth.edu/undergraduate/honors/

- **Yilan Hu '10** (Carl Pomerance, advisor) "The average order of elements in the multiplicative group of a finite field"
- **Miles Kenyon '10** (Dan Rockmore, advisor) "Semantic analysis of fine-scale structures in the Wikipedia network"
- **Zoe Lawrence '10** (Dorothy Wallace and Alex Barnett, co-advisors) "The spatiotempor-

al dynamics of African Cassava Mosaic Disease"
- **Cyrus Peterpaul '10** (Carolyn Gordon, advisor) "Warped Products of Isospectral Graphs"
- **Seunghee Ye '10** (Craig Sutton, advisor) "Isospectral surfaces with distinct covering spectra"

Presidential Scholars

The James O. Freedman Presidential Scholars Program was initiated in 1988 and provides opportunities for juniors to work as research assistants with Dartmouth faculty. These opportunities are intended to prepare students for undertaking senior honors theses.

The following students received math Assistantships:
- **Kamil Adamczewski '11** (Dorothy Wallace, advisor) "Investigation of various measures of innovation on surgical techniques"
- **Kathleen P. Champion '11** (Alex Barnett co-advisor with Amy Gladfelter, Biology) "Mathematical algorithms for tracking genealogy of nuclei microscopy videos"
- **Mateusz W. Grudzien '11** (Rosa Orellana, advisor) "Graphs and Polynomials"
- **Alison K. Herdeg '11** (Rosa Orellana, advisor) "Graphs and Polynomials"
- **Katherine S. Roddy '11** (Scott Pauls, advisor) "Geometric structure of real world networks associated to geographical weather data"

Women in Science Program (WISP)
http://www.dartmouth.edu/~wisp/

Dartmouth College established WISP in 1990 to address the under-representation of women in science, mathematics, and engineering. Dartmouth designed WISP with a focus on retaining women in science and an emphasis on women in their first year.

WISP interns typically work in their winter and spring terms which ends in the culminating experience of the Karen E. Wetterhahn Science Symposium in May where interns make and display science posters from their internship research projects. The Mathematics department is one of the STEM areas of

science and is therefore open to Sophomore women as well as first years.

In the winter and spring term of 2010 three WISP interns worked on research projects in the Mathematics department. **Xiaoxi Niu '13** and **Rachel Yang '13** worked with Professor Emeritus Bob Norman on the project "Comparing Voting Systems." **Tasneem Khalid '12** worked with Professor Dorothy Wallace on the project "Mathematics applications in biology or medicine."

Professor Emeritus Bob Norman has been a WISP sponsor for 19 years and has sponsored 52 interns! Professor Wallace has participated for a total of seven years since 2000 and sponsored eight interns. Professor Elizalde has sponsored two interns since 2009.

Association for Women in Mathematics
http://www.math.dartmouth.edu/~awm/

The Association for Women in Mathematics (AWM) Student Chapter had a very active year under the leadership of undergraduates Katherine Roddy '11 (president), Jessica Wheeler '10 (co-president), Cacey Tang '11, Erica Serpico '12, Olivia Liu '11 and Rachel Yang '13.

Graduate students served as mentors to undergraduate women. The AWM and the Dartmouth Mathematics Society jointly held an information night for students interested in summer research experiences or opportunities to study mathematics abroad. The AWM sponsored a series of lunches with faculty members and with women mathematicians visiting Dartmouth from other universities. As the snow fell in the winter, the AWM invited children and their mentors in DREAM (a Dartmouth group that mentors children from the area) to a delightful afternoon of winter-themed crafts, snacks and mathematics, including a discussion of symmetry while making paper snowflakes.

Math Society
http://www.math.dartmouth.edu/~mathteam/

There is a thriving "mathematical community" on campus. **The Dartmouth Math Society** has regular meetings with activities that include lectures by invited faculty members, graduate and undergraduate students, information sessions and mathematics related movies.

In the 2009-10 academic year the president of the Math Society was **Hee-Sung Yang '12** and the vice president was **Aria Anavi '11**. The faculty advisors for the DMS are Professors Rosa Orellana and Vladimir Chernov.

Listed below are some of the activities of the DMS for the last academic year.

Talks by Mathematics Department regular and visiting faculty:
- Professor **Peter Doyle** "How to Tell Wallpaper," Oct 5, 2009
- Professor **Alexander Barnett** "Numerical methods for scattering and trapping of waves," Oct 12, 2009
- Professor **Peter Winkler** "Lessons from Vegas: On Probability and Intuition," Oct 19, 2009
- Professor **Jody Trout** "Mathematics and the Mythos: All the Wrong Angles," Oct 26, 2009
- Professor **Vladimir Chernov** "Introduction to Virtual Knot Theory," January 13, 2010
- Professor **Thomas Shemanske** "Polygonal Numbers and Additive Number Theory," January 27, 2010
- Professor **Robert Norman**, emeritus "A Mathematician Looks at Voting Systems" Feb 10, 2010
- Professor **Carolyn Gordon** "You Can't Hear the Shape of Drums," Apr 7, 2010
- Professor **Carl Pomerance** "Fibonacci Integers," May 5, 2010
- Professor **Erik van Erp** "What is Non-Commutative Geometry?" May 19, 2010
- Professor **Marcia Groszek** "The Unsolution of Hilbert's Tenth Problem," May 26, 2010

Talks by our graduate students:
- **Lola Thompson**, GR "Coefficients of Cyclotomic Polynomials," Nov 9, 2009
- **Patricia Cahn**, GR "Knots!" Nov 23, 2009
- **Paul Kinlaw**, GR "Introduction to Lorentzian Geometry and Space-Time," April 21, 2010

Talks by Dartmouth alumni:
- **Paul Kinson** '81 "On Actuarial Professions," Nov 2, 2009

Additional events:

- **Lola Thompson** and **Elizabeth Gillaspy,** GR, served as panelists for the DMS-AWM Joint Info Session on REU and Grad Schools which was organized by the Math Society and the Association of Women in Mathematics (Nov 16, 2009)

Thayer Mathematics Exam

The Thayer Prize Mathematical Exam is an annual tradition for the Mathematics Department. The exam is an excellent opportunity for first-year students to test their problem solving skills. The names of the winners are put on a plaque in the undergraduate lounge in Kemeny Hall. Professor Vladimir Chernov and Professor Sergi Elizalde served on the Thayer Exam Committee.

This year we had a tie for first place:

2010 Winners

Alan Xu '13, 1st place
Noah Lebowitz-Lockard '13, 1st place
Jeremy Brouillet '13, 2nd place
Vipul Kakkad '13, Honorable Mention

Curriculum News

Current listing of courses offered by the Math Dept can be reviewed in the ORC online at:
http://www.dartmouth.edu/~reg/courses/desc/

We now have 7 math minors with the addition of minors in: **Mathematical Biology**, **Mathematical Logic**, **Mathematical Physics** and **Mathematical Finance**. In addition, we have added a new **Modified Major in Mathematics and Philosophy**.

Five graduate students, who recently received their Master of Arts in Mathematics from Dartmouth, completed the "**Teaching Seminar**," a seven week two credit intensive course in the teaching and learning of mathematics that includes two weeks of practice teaching. Occasionally students from outside our department have taken the course, and we have recently formalized this option. This year's class, **Elizabeth Gillaspy, Katherine Kinnaird, Asa Levi, Natasha**

Komarov, Michael Wijaya and a recent Dartmouth physics PhD who took the course in preparation for a tenure track job, chose to focus on "The Four Color Theorem" and "Bijections and Infinity" for the two weeks of practice teaching.

The goal of the seminar is to prepare students to teach their first Dartmouth class and to give them tools for ongoing professional development as teachers. In addition to Mathematics Department faculty members, there were guests from the Dartmouth Center for the Advancement of Learning, the First Year Dean's Office, the Academic Skills Center and Student Accessibility Services.

As part of their preparation the students in the seminar organized and ran two week-long "Exploring Math" camps for local middle and high school students. Over 20 local participants attended each of the two sessions, coming from Hanover, Lebanon, Grantham and Concord, New Hampshire as well as Norwich, Sharon, White River Junction, Northfield and Strafford, Vermont; Ridgefield and New Canaan, CT; Dix Hills, NY; Sylva, NC; San Jose, CA; and Polo, Italy.

In addition to benefiting Dartmouth graduate students and the undergraduates they teach, this summer experience provides a valuable link between our department and the communities in which we live and work.

Last year, Dartmouth announced a new program agreement between **Dartmouth Graduate Studies** and **The Tuck School of Business**, paving the way for a Dartmouth PhD to obtain an accelerated MBA degree. For more information on this program go to: http://www.dartmouth.edu/~gradstdy/programs/dartmouthphdmba.html.

Digital Library for Alumni

The Alumni Digital Library continues to be a sought after resource, just for you, Dartmouth College alumnus/alumna. The recently redesigned alumni webpage includes a single search box to find articles in all of the databases your status allows you to search remotely. Through special arrangements and funding, alumni have remote access to a selection of full-text articles in hundreds of newspapers and magazines. Mathematics titles accessed recently from this collection include International Journal Of Mathematics, Inventiones Mathematicae, and Journal Of Mathematical Sciences.

Don't forget that you have lifetime access to all of our library resources onsite including access to our thousands of licensed digital resources from any of the libraries, either at computers provided or by connecting to the Dartmouth Library Public wireless network. http://www.dartmouth.edu/~library/alumni/