



# MATH IS POWER



Department of Mathematics  
Dartmouth College - Hanover, NH  
September 2012

## *Letter from the Chair, Dan Rockmore*

Welcome to the fifth annual newsletter of the Department of Mathematics. 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. We have had several new research grants, many more publications, some media attention, a 2012 class of 53 majors, 7 minors, and 5 senior theses. We also organized the Sonia Kovalevsky Math Day, which was attended by over 80 Middle and High School students and teachers. Other outreach activities included our annual Reese T. Prosser Lecture and Kemeny Public Lecture (and Lecture Series) scheduled for the fall and spring respectively. The posters from these events are below and more information 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.

We hope you enjoy the newsletter. We are hoping to enlarge our alumni section for next year, for you to share any updates (professional or personal) or news. If you have anything you wish to share, or if you know of any other alumni or others who might enjoy our newsletter please email **Stephanie Kvam** ([deptaa@math.dartmouth.edu](mailto:deptaa@math.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](http://www.math.dartmouth.edu)) for more information.

With best regards and best wishes,

Dan Rockmore  
William H. Neukom Professor of Computational Science  
Chair, Department of Mathematics

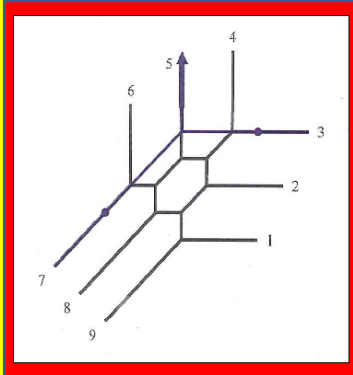


## 2012 Kemeny Undergraduate Lecture



### TROPICAL MATHEMATICS

In tropical arithmetic, the sum of two numbers is their maximum and the product of two numbers is their usual sum. Many results familiar from algebra and geometry, including the Quadratic Formula, the Fundamental Theorem of Algebra, and Bezout's Theorem, continue to hold in the tropical world. In this lecture we learn how to draw tropical curves and why evolutionary biologists might care about this.



Tuesday, May 1, 2012  
7:00 - 8:00 PM

Arvo J. Oopik 1978 Auditorium (Room 100)  
Class of 1978 Life Sciences Center

#### Bernd Sturmfels

#### University of California, Berkeley

Bernd Sturmfels, Professor of Mathematics, Statistics and Computer Science: honors include a National Young Investigator Fellowship, a Sloan Fellowship, and a David and Lucile Packard Fellowship, a Clay Senior Scholarship, an Alexander von Humboldt Senior Research Prize, the SIAM von Neumann Lectureship, and a Sarlo Distinguished Mentoring Award. Recently, he served as Vice President of the American Mathematical Society. A leading experimentalist among mathematicians, Sturmfels has authored ten books and over 200 research articles, in the areas of combinatorics, algebraic geometry, symbolic computation and their applications. He has mentored 35 doctoral students and numerous postdocs. His current research focuses on algebraic methods in optimization, statistics and computational biology.



Everybody Welcome!



For more information:  
<http://www.math.dartmouth.edu/activities/kemeny-lectures/>

2012 Kemeny Undergraduate Lecture


The Reese T. Prosser  
Mathematica Lecture Series  
Presents

## From Democratic Consensus to Cannibalistic Hordes: The Principles of Collective Behavior

Tuesday, November 15, 2011  
7:00 - 8:00 PM  
Filene Auditorium  
Moore Hall

**Abstract:**  
Collective organization is everywhere, both around us and within us. Our brains are composed of billions of interconnected cells communicating with chemical and electrical signals. We are integrated in our own collective human society. Elsewhere in the natural world a flock of birds arcs and ripples while descending to roost, and a fish school convulses, as if it is a single entity, when attacked by a predator. How can animal groups move in unison? How does individual behavior produce group dynamics? Do animal groups function as a "collective mind"? From locust swarms to bird flocks, from consensus decision-making in fish and among humans, Couzin employs an integrated mathematical and experimental approach to investigate how, and why, coordinated collective behavior is so pervasive within the natural world.



### IAIN COUZIN

Assistant Professor, Department of Ecology and Evolutionary Biology & Program in Applied and Computational Mathematics, Princeton University

The Reese Prosser Memorial Lectures were inaugurated in 2002 by the Department of Mathematics at Dartmouth College to honor their long time colleague Reese Prosser. This lecture series, endowed by the late Nancy Prosser and her family, is intended to introduce the general public to mathematical research related to their daily lives.

*Free and open to the public.*

2011 Reese T. Prosser Lecture

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*In Memory of James E. Baumgartner  
(1943-2011)  
Professor Emeritus  
Dartmouth College*



Jim Baumgartner, John G. Kemeny Professor of Mathematics Emeritus, passed away shortly after Christmas 2011. Jim was born in Kansas in 1943. As an undergraduate he attended the California Institute of Technology and eventually got his bachelor's degree from the University of California at Berkeley. He came to Dartmouth in 1969 after getting his Ph.D. at Berkeley under Robert Vaught. Except for brief visiting appointments at Cal Tech and Berkeley, Jim spent his entire career at Dartmouth. Jim served as Department Chair from 1995 to 1998, but was always a source of inspiration and leadership in the Department until his battle with multiple sclerosis forced his early retirement in 2004.

Jim worked in mathematical logic and set theory and made particularly important contributions to the subject of forcing. Forcing is a technique for proving consistency and independence results in set theory, introduced by Paul Cohen in his 1963 proof of the independence of the continuum hypothesis. A consistency result shows that some mathematical statement cannot be disproven from the usual axioms; an independence result shows a statement can be neither proven nor disproven. Very broadly, forcing is used to explore the possible structure of the mathematical universe. It allows one to extend a model of set theory to another model with different properties (such as the failure of the continuum hypothesis); iterated forcing creates a new model via a transfinite sequence of successive extensions. Jim did important, foundational work developing techniques and proving general theorems about forcing and iterated forcing.

The existence of independence results in set theory, questions that cannot be answered using the usual axioms, leads to the search for stronger axioms that can settle these questions. One major class of axioms is derived by using the theory of forcing to formulate axioms that say, in various precise ways, "the universe of mathematics is rich." Jim formulated perhaps the most important of these axioms, the Proper Forcing Axiom, and proved its relative consistency.

Jim proved many important and often surprising results in other areas of set theory, including both set theoretic topology and infinitary combinatorics. The Baumgartner-Hajnal theorem, for example, is important not only for the result but also for the remarkable technique used in the proof.

Suffice it to say that his research accomplishments made him a giant in his subject. His influence stemmed not only from the importance and the beauty of the mathematics he created, but also from the insight and clarity of his exposition, and his remarkable initiative and generosity as a colleague and mentor.

Jim was as gifted a teacher as he was a mathematician. He cared passionately about both. In addition to being one of our best undergraduate lecturers, Jim had eight Ph.D. students at Dartmouth (as well as 3 more at other institutions) and he mentored numerous John Wesley Young Research Instructors who came to Dartmouth to work and learn from Jim. He not only fit the "Dartmouth mold;" he was its champion. He will be sorely missed by his colleagues, friends and family for his intellectual brilliance, common sense and his devotion to students and to mathematics.

Marcia Groszek and Dana Williams  
Dartmouth College  
Mathematics Department  
September 2012

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## *Faculty Highlights*

This past year we welcomed two new John Wesley Young postdoctoral instructors: **Adrianna Gillman** in fast algorithms for partial differential equations (Ph.D. at University of Colorado at Boulder, advisor: Alex Barnett) and **Zajj Daugherty** in combinatorics and representation theory (Ph.D. at University of Wisconsin at Madison, advisor: Rosa Orellana).

**Martino Arkowitz** was invited to be a Visiting Professor at Chonbuk National University in the Jeonju, Republic of Korea (Sept – Oct 2011). During his stay he gave a lecture entitled “Comultiplications.”

High-frequency eigenfunctions computed by **Alex Barnett** appeared in Peter Sarnak’s article “Recent progress on the Quantum Unique Ergodicity Conjecture” in the Bulletin of the AMS. Alex presented his research at seminars and conferences at NJIT, UNC, Texas A&M, and WAVES2011 at Vancouver. He also co-organized (with Laurent Demanet of MIT) an 8-speaker mini-symposium at ICIAM2011 in Vancouver, on periodic scattering and high-frequency waves. He and Adrianna Gillman mentored undergraduate students to successfully start a local SIAM Student Chapter (2012).

**Vladimir Chernov** gave a variety of talks over the past year including: “Smooth Cosmic Censorship and determining causality from linking” at the Depto. de Matematicas, CINVESTAV, Mexico City, Mexico (Mar 2012), “Smooth Cosmic Censorship” at the XXXIV Knots in Washington Conference held at George Washington University in Washington, DC (Mar 2012), a three lecture mini-course “Causality and Legendrian Linking” at the VI International Meeting on Lorentzian Geometry in Granada, Spain (Sept 2011), and “Low conjecture, linking and causality in global hyperbolic Lorentz spacetimes” at the The 87th Encounter between Mathematicians and Theoretical Physicists “Lorentz geometry in Mathematics and in Physics” dedicated to Norbert A Campo for his 70th birthday (Jun 2011). Besides talks, he served as the chair of the “Mathematics in Moscow” committee of AMS (2011-2012), co-coached the Dartmouth team for the Putnam Mathematics Exam with Professor Elizalde, and

served as the secondary Advisor to Mathematics Majors.

**Peter Doyle** ran an informal research seminar whose members were Dan Denton ’08, Noah Lebowitz-Lockard ’13, Hanh Nguyen ’14, and Jesse Selover ’15.

**Sergi Elizalde** gave talks at the conference on Formal Power Series and Algebraic Combinatorics (FPSAC) in Reykjavik, Iceland (Jun. 2011), the University of Miami Combinatorics Seminar (Feb. 2012), the University of Florida Mathematics Colloquium (Feb. 2012), and he was a plenary speaker at the conference CombinaTexas, in Georgetown, TX (Apr. 2012). During the 2011-2012 academic year, Elizalde was a guest editor for the special issue of the journal Pure Mathematics and Applications (PuMA) devoted to the Proceedings of the conference Permutation Patterns 2010. He also refereed papers for 10 different journals, and was a reviewer for Mathematical Reviews and for the NSERC of Canada.

**Carolyn Gordon** was selected by the Mathematical Association of America to present an hour invited address at the Joint Mathematics Meetings. She presented the lecture “The sound of geometryin” (Jan 2012). She lectured “Geometric structures on manifolds and their applications” at a lecture held in a castle in Marburg, Germany. She gave a plenary lecture at “Women in Math in New England,” an undergraduate conference at Smith College (Sept 2011). She co-organized a Special Session on “Riemannian Geometry” at “40 Years and Counting,” the Assoc. for Women in Mathematics’ anniversary celebration, ICERM, Brown University (Oct 2011). She also helped organize a MAA Special Session on “Decoding Geometry” at the Joint Mathematics Meetings (Jan 2012). She was on the scientific committee for a conference on “Global harmonic analysis” held at the University of Kentucky (Jun 2011). She, along with Rosa Orellana, served as co-advisors to the Dartmouth Chapter of Association for Women in Mathematics.

**Marcia Groszek** is a member of the Association for Symbolic Logic Committee on Logic Education, and has reviewed papers for assorted logic journals. She oversees the department’s GAANN fellowship program, in particular, leading the fall term TA discussion group. She is pleased to announce that her older son, a former student at Dartmouth’s Exploring Math camp, has just started college at the University of Vermont as a mathematics major.

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**Rosa Orellana** took a leading role in forming a nine person committee to continue the Discrete Math Days in the Northeast conference series. She obtained funding from the NSA to support four meetings over the next two years. In addition, she gave invited talks at the NY Workshop on the symmetric group; Queens Algebra, Number Theory for Undergraduates (QUANTUM) minority students; Two talks at the AWM Anniversary at Brown University, 40 years and counting in “Group Theory and Its Connections to Representation Theory” and “Geometry and Combinatorics in Flag Manifolds and Beyond”; the session in “Interdisciplinary Algebra” at the Society for the Advancement of Chicanos and Native Americans in Science; Combinatorics Seminar at MIT; Combinatorial Algebra meets Algebraic Combinatorics workshop and spoke at the Dartmouth Math Society. She also completed serving her three year appointment for the Human Resources Advisory Committee for MSRI (Mathematical Sciences Research Institute). She co-organized a special session in “Combinatorial Representation Theory” for the American Mathematical Society. At Dartmouth she continues serving as a member of the COI (Committee on Instruction) and she served on a Working Group on Academic at Risk and Re-Entry Students.

**Scott Pauls** continues his research in the analysis of complex systems, with current applications to economics, neuroscience, political science and sociology. He spoke at the 8th International Conference on Complex Systems at the New England Complex Systems Institute in June, 2011 as well as the 5th Annual Conference on Political Networks at the University of Colorado (Boulder) in June 2012. He continues to serve as Vice Chair of the department and as the First-Year Adviser for Mathematics. He chairs the Recruiting Committee, is a member of the FYSEP steering committee, serves on the Committee on Organization and Policy (COP), and participates in the Strategic Planning group on Graduate Education.

**Carl Pomerance** gave many talks over the past year including ones at U. Vermont, U. Montreal, U. Maine, U. West Virginia, the West Coast Number Theory Conference (Asilomar, CA), special sessions of the Joint Math Meetings (Boston, MA), U. C. Irvine, the AMS Western Section Meeting Special

Session (Honolulu, HI), U. Newcastle (Australia), and the Canadian Number Theory Association bi-annual meeting (Lethbridge, Alberta). Pomerance was elected as a Fellow of the American Mathematical Society, and he serves as President of the Number Theory Foundation. He is on the editorial committee of several journals, including *Involve*, which features undergraduate research.

**Dan Rockmore** was very busy during the past academic year. He was invited to give the talk “Info-Metrics” (Mar 2012). He was a panel participant at the NSF-CAISE PI meeting (Mar 2012). Dan was a member of the American Mathematical Society Proceedings of Symposia in Applied Mathematics Editorial Committee (2012—2016) and the New York Academy of Sciences Blavatnik Prize Committee (2011-2012). He was on the editorial board of the New Princeton University Press, SFI Primers in Complex Systems series (2009-2012). He refereed numerous journals including *Journal Fourier Analysis*, *IMA Journal of Numerical Analysis*, *IEEE Signal Processing Magazine*, *Groups, Geometry, and Dynamics*, *NSF ISE*, *NSF CCR*, *American Mathematical Monthly*, *Chaos*, *American Institute of Physics*, *Advances in Applied Mathematics*, *IEEE Transactions in Image Processing*, and *Applied and Computational Harmonic Analysis*. He served on the NSF Panel ISE (2012). He is a member of the Science Steering Committee at The Santa Fe Institute (2010-2013), the Digital Dartmouth SP working group, the Year of the Arts Steering Committee, and the Steering Committee of the Dartmouth Writing Summit. Besides serving as the Chair of the Math Department, he is also the Director of the Neukom Institute for Computational Science. Lastly, he co-organized and provided funding for (via Neukom Institute) the cross-campus informal evening faculty seminar, “What’s the Big Idea?”

**Craig Sutton** presented results on the relationship between the moments of inertia of a molecule and its rotational spectrum at the Pacific Northwest Geometry Seminar (May 2011).

**Jody Trout** gave two talks at Northern Arizona University: “Asymptotic Morphisms and the spinc-Dirac operator on the Cotangent Bundle” at the Applied Math Seminar and “The Fourth Dimension Across the Curriculum” at the Math Department Colloquium (Nov 2011). He is also the faculty advisor for the Orthodox Student Fellowship (OCF) at Dartmouth.

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**Erik van Erp**, John Wesley Young Research Instructor, accepted an Assistant Professor position at University of Hawaii at Manoa. Best of luck!

**Dorothy Wallace** gave a variety of talks this past year including: “Sexually differentiated death rates in the presence of an efficient mating strategy” at the Annual meeting of the Society for Mathematical Biology, Krakow, Poland (Summer 2011); “Building Financial Literacy Content in College Courses,” at a faculty development workshop at Champlain College in Burlington, VT (Summer 2011); plenary lecture “Testing and Tuning a Tumor Growth Model with Angiogenesis and Vasculogenesis,” at the International Symposium on Mathematical and Computational Biology (BIOMAT) (Fall 2011); “Empowerment through numbers: financial literacy in the US and beyond,” at the Dartmouth Financial Literacy Initiative (Dec 2011); and “Online Modules for Teaching Financial Literacy,” at a faculty development workshop sponsored by Jumpstart in Burlington, VT (Mar 2012). She also organized workshops for curriculum development for the Financial Literacy Center (Fall 2011).

**David Webb** and **Carolyn Gordon** co-organized a special session of the Mathematical Association of America, “Decoding Geometry,” at the annual Joint Mathematics Meetings (Jan 2012).

**Dana Williams** was appointed a Visiting Scholar at the University of Muenster, Germany (Sept 2011). He gave the talk “Regularity and Amenability for Fell Bundles over Groupoids” at Groupoidfest (U. of Nevada – Ren, Jan 2012). Another talk “Renault’s Equivalence Theorem for Reduced Algebras” was given at the East Coast Operator Algebras Symposium at Purdue University (Oct 2011). He organized the New Hampshire Operator Theory Symposium (Nov 2011). He also serves as the Advisor to all Math Majors and Minors.

**Pete Winkler** was appointed a Simons Visiting Professor at the Mathematical Sciences Research Institute (MSRI) at Berkeley (winter and spring 2012). He gave an Erdős Lecture at the University of Memphis (May 2012). In addition, he gave numerous talks at MSRI - Berkley, Stanford U., St. Mary’s College, U. of California - Davis, Japan Institute of Advanced Studies in Technology (Kanazawa, Japan),

Microsoft Research Theory Lunch (Redmond, WA), Seattle U., U. of Washington, U. of British Columbia, Fields Institute (Toronto, ON), Columbia U., and a workshop in Bristol, UK. He edited the Problems in Mathematics book series, Springer-Verlag, 2004–present. He organized and participated in the MSRI Focus on Random Spatial Processes (Jan-May 2012). Winkler also writes the monthly puzzle column in Communications of the Association for Computing Machinery (ACM), and he gives numerous talks to mathematics teachers (K-12 and college), high school students and undergraduates on mathematical and mechanical puzzles.

**Andrew Yang**, John Wesley Young Research Instructor, accepted a position in private industry. All the best!

### *Publications*

**A. H. Barnett** and A. Hassell, Boundary quasi-orthogonality and sharp inclusion bounds for large Dirichlet eigenvalues, *SIAM J. Numer. Anal.*, **49** (2011), 1046–1063.

**A. H. Barnett**, L. Polansky, and M. Winter, A few more words about James Tenney: dissonant counterpoint and statistical feedback, *J. Math. Music*, **5**, (2011), no. 2, 63–82.

**A. H. Barnett**, Convolution: son et lumière, *Convolution: A journal for experimental criticism*, **1** (2011).

R. Braun, G. Leibon, **S. Pauls**, and **D. Rockmore**, Partition decoupling for multi-gene analysis of gene expression profiling data, *BMC Bioinformatics*, 2011; 12:497 doi:10.1186/1471-2105-12-497.

P. Cahn and **V. Chernov**, Intersections of Loops and the Andersen-Mattes-Reshetikhin Algebra, *Journal of the London Mathematical Society*, submitted 2011; arXiv:1105.4638.

**V. Chernov** and S. Nemirovski, Smooth cosmic censorship, *Communications in Mathematical Physics*, submitted 2012; arXiv:1201.6070.

- D. Denton and **P. Doyle**, Shadow movies not arising from knots, arXiv:1106.3545v1 [math.GT], version 1.0, dated 17 June 2011.
- B. De Smit, R. Gornet, and **C. Sutton**, Isospectral surfaces with distinct covering spectra via Cayley graphs, *Geom. Dedicata*, to appear 2012, 12 pages.
- E. Deutsch and **S. Elizalde**, Restricted simsun permutations, *Ann. Comb.*, **16** (2012), 253--269.
- P. Doyle**, Stackable and queueable permutations, arXiv:1201.6580v1 [math.CO], version 1.0, dated 30 January 2012, public domain.
- A. Ekstrom, **C. Pomerance**, and D. Thakur, Infinitude of elliptic Carmichael numbers, *J. Australian Math. Soc.*, **92** (2012), 45-60.
- S. Elizalde**, Allowed patterns of beta-shifts, *Discrete Math. Theor. Comput. Sci. proc. AO* (2011), 293-304.
- S. Elizalde**, Descent sets of cyclic permutations, *Adv. in Appl. Math.*, **47** (2011), 688-709.
- S. Elizalde**, Fixed points and excedances in restricted permutations, *Electron. J. Combin.*, **18** (2012), #P29.
- S. Elizalde**, Permutations and beta-shifts, *J. Combin. Theory Ser. A*, **118** (2011), 2474-2497.
- S. Elizalde**, The X-Class and almost-increasing permutations, *Ann. Comb.*, **15** (2011), 51-68.
- A. Georgakopoulos and **P. Winkler**, Two-color Babylon, *Integers* **12** (2012), #G1.
- J. J. Alba Gonzalez, F. Luca, **C. Pomerance**, and I. E. Shparlinski, On positive integers  $n$  dividing the  $n$ th term of a linearly recurrent sequence, *Proc. Edinburgh Math. Soc.*, **55** (2012), 271-289.
- D. Graham, J. Hughes, H. Leder, and **D. Rockmore**, Statistics, vision, and the analysis of artistic style, *WIREs Computational Statistics*, 2011; doi: 10.1002/wics.197 .
- D. Graham, J. M. Hughes, T. Markevicius, and **D. Rockmore**, "Esther at the Palace Gates" and "The Triumph of Mordecai" at the National Gallery of Canada reconsidered: new findings with IR reflectography and the new method of computational stylometry identifying Botticelli and Filippino Lippi involvement in the c.1475 cassoni cycle depicting the Story of Esther, *Art '11 Conference*.
- Astrid an Huef, Steven Kaliszewski, Iain Raeburn, and **Dana P. Williams**, Naturality of Rieffel's Morita equivalence for proper actions, *Algebr. Repr. Theory*, **14** (2011), 515-543; arXiv:math.OA.0810.2819.
- Astrid an Huef, Iain Raeburn, and **Dana P. Williams**, Functoriality of Rieffel's generalised fixed-point algebras for proper actions, *Proc. Symp. in Pure Math.*, **81** (2012), 9-25.
- J. Hughes and **D. Rockmore**, developed an iPad app for the Hood as a means of augmenting the viewer experience of the Orozco Murals. These iPads will be available at the reserve desk by the murals.
- P. Kurlberg, J. C. Lagarias, and **C. Pomerance**, The maximal density of product-free sets in  $\mathbb{Z}/n\mathbb{Z}$ , *Int. Math. Res. Not.*, February 14, 2012, doi:10.1093/imrn/ms014.
- B. Linowitz and **T. Shemanske**, Embedding orders into central simple algebras. *Journal de théorie des nombres de Bordeaux*, **24** (2012), no. 2, 405-424.
- B. Linowitz and **T. Shemanske**, Selective Orders in Central Simple Algebras, arXiv:1204.2526 [math.NT], submitted.
- F. Luca and **C. Pomerance**, On composite integers  $n$  for which  $\phi(n)|n-1$ , *Bol. Soc. Mat. Mex.*, **17** (2011), 13-21.
- E. Makover, H. Parlier, and **C. Sutton**, Constructing metrics on a 2-torus with a partially prescribed stable norm, *Manuscripta Math.*, to appear, 20 pages.
- G. Martin and **C. Pomerance**, Primitive sets with large counting function, *Publ. Math. Debrecen*, **77** (2011), 521-530.
- S. Pauls** and D. Remondini, A notion of centrality based on the spectrum of the Laplacian, *Phys. Rev.*, 2012; E.85:066127.
- D. Rockmore**, Elevenses, *VPR Commentary*, 11/11/11.

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**D. Rockmore**, Happy Pi Day, *VPR Commentary*, 3/14/12.

**D. Rockmore**, Invited Foreword of [Who is Fourier?: A Mathematical Adventure](#), Language Research Foundation, 2012.

B. Schmidt and **C. Sutton**, Two remarks on the length spectrum of a Riemannian manifold, *Proc. Amer. Math. Soc.*, **139** (2011), 4113-4119.

**D. Wallace**, Parts of the Whole: An Algebra Lesson, *Numeracy*, **4** (2011), no. 2, article 10.

**D. Wallace**, Parts of the Whole: Learn More, Learn Better, *Numeracy*, **5** (2012), no. 1, article 8.

**D. Wallace** with numerous collaborators, Money Matters Modules, author and editor, ten modules for teaching financial literacy, available at <http://www.math.dartmouth.edu/~mqed/FinancialLiteracyProject/modules.php>, 2011.

G. Weaver, N. Foti, S. Bratus, **D. Rockmore**, and S. Smith, Using Hierarchical Change Mining to Manage Network Security Policy Evolution, *The Workshop on Hot Topics in Management of Internet, Cloud, and Enterprise Networks and Services* (Hot-ICE '11), 2011.

**P. Winkler**, Book Review of [Famous Puzzles of Great Mathematicians](#) by Miodrag Petković, *Amer. Math. Monthly*, **118** (2011).

### *Fellowships, Grants and Awards*

**Alex Barnett** received Dartmouth College's 2011 Burke Initiation Award and the Elizabeth R. and Robert A. Jeffe 1972 Fellowship.

**Rosa Orellana** received a grant from the NSA for 4 Discrete Mathematics Days that will take place at Middlebury (Sept 2012), Worcester Polytechnic Institute (WPI) (Spring 2012), Bard College (Fall 2013) and Dartmouth College (Spring 2013). She also received a grant from the Association for Women in Mathematics through NSF to fund the first Sonia Kovalevsky Math Day at Dartmouth. To read

more about the first Sonia Kovalevsky Day, please refer to the conferences section of the newsletter.

**Dan Rockmore** received the grant "AFOSR Dynamic Information Networks: Geometry, Topology, and Statistical Learning for the Articulation of Structure," PI, 2011-2014.

**Craig Sutton** received the NSF Grant "Problems in Geometric Analysis," DMS-0906168, co-pi, 2009-2012.

**Dorothy Wallace** with Annamaria Lusardi and Kim Rheinlander received the grant "Building Financial Literacy Content in College Courses," Social Security Administration, extended to 2011-2012 at no cost.

**David Webb** received a six-month extension on the three-year continuing grant "Spectral and Geometric Problems in Global Analysis" from the NSF, co-PI.

**Dana Williams** and **Vladimir Chernov** have each been awarded a 5-year Simons Foundation Collaboration Grant.

### *Colloquia, Seminars, and Meetings*

The 2011-2012 **Kemeny Lecture Series** in April featured Professor **Bernd Sturmfels**, Professor of Mathematics, Statistics and Computer Science at University of California, Berkeley. Professor Sturmfels presented three lectures: "The Central Curve in Linear Programming," "Convex Algebraic Geometry," and "Tropical Mathematics." To view past and future Kemeny Lectures go to:

<https://www.math.dartmouth.edu/activities/kemeny-lectures/>

The 2011-2012 **Reese T. Prosser Memorial Lecture** in November featured **Iain Couzin**, Assistant Professor, Department of Ecology and Evolutionary Biology & Program in Applied and Computational Mathematics at Princeton University. Professor Couzin lectured on: "From Democratic Consensus to Cannibalistic Hordes: The Principles of Collective Behavior." To view past and future Prosser Lectures go to:

<https://www.math.dartmouth.edu/activities/prosser-lectures/>



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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 2011 Colloquia talks were:

- **Rosa Sena-Dias**, Instituto Superior Tecnico, Lisbon, Portugal, “Spectral results on toric manifolds”
- **Miguel Sánchez**, Universidad de Granada, Spain, “An excursion in Lorentzian Geometry: from linear algebra to the structure of the universe”
- **Craig A. Tracy**, UC Davis, “Turbulent liquid crystals, KPZ universality, and the asymmetric simple exclusion process”
- **Dino Lorenzini**, U. Georgia, “The index of an algebraic variety”
- **Douglas Ulmer**, Georgia Institute of Technology, “Elliptic curves with many points”
- **Petra Bonfert-Taylor**, Wesleyan University, “Quasiconformal homogeneity of hyperbolic manifolds”
- **Amit Chakrabarti**, Dartmouth College, Computer Science Dept., “Information complexity: A paradigm for proving lower bounds”
- **Joan Licata**, Institute for Advanced Study, Princeton, NJ, “Topological approaches to contact geometry”
- **Christelle Vincent**, University of Wisconsin, “On the construction of rational points on elliptic curves”
- **Kathryn Nyman**, Willamette University, “The peak algebra of the symmetric group”

The Winter 2012 Colloquia talks were:

- **Peter Buser**, Ecole Polytechnique Federale de Lausanne, “On the history of the length spectrum”
- **Tom Halverson**, Macalester College, “Groups and their Representation Graphs”
- **Sheila Margherita Sandon**, Institute for Advanced Study, “Rigidity phenomena in Contact Topology”
- **Charles Frohman**, University of Iowa, “Skeins and Characters”

- **Ben McReynolds**, Purdue University, “Symmetry problems in geometry and algebra”
- **Gregory Beylkin**, University of Colorado at Boulder, “Approximations of Green’s Functions and Fast Algorithms”
- **Lowell Abrams**, The George Washington University, “Cellular Automorphisms of Surfaces and Self-Duality”
- **Adrianna Gillman**, Dartmouth College, “Fast numerical methods for solving elliptic partial differential equations”
- **Kyle Petersen**, DePaul University, “What is the gamma-vector? (And what does it count?)”

The Spring 2012 Colloquia talks were:

- **Zajj Daugherty**, Dartmouth College, “The two-boundary braid group and its amazing quotients”
- **Emilio Elizalde**, ICE/CSIC and IEEC, Autonomous University of Barcelona (UAB), Spain, “Mathematics and Cosmology: on the Universe acceleration and the zeta function as a regularization tool”
- **Marcelo Aguiar**, Texas A & M University, “Lie theory based on hyperplane arrangements”
- **Rostislav Grigorchuk**, Texas A & M University, “On Gap Conjecture for group growth and related topics”
- **Thomas Lam**, University of Michigan, “Electrical networks and Lie theory”
- **Bernd Sturmfels**, UC Berkeley, “Tropical Mathematics”
- **Bernd Sturmfels**, UC Berkeley, “Convex Algebraic Geometry”
- **Bernd Sturmfels**, UC Berkeley, “The Central Curve in Linear Programming”
- **Ben Schmidt**, Michigan State University, “Three dimensional manifolds with constant vector curvature”
- **Craig Spencer**, Kansas State University, “Directional Discrepancy”
- **Olivier Bernardi**, Massachusetts Institute of Technology, “A master bijection for planar maps”

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## *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 2011-2012 academic year were:

- Jean Renault (Université d'Orléans, France)
- Paul Baum (The Pennsylvania State University)
- Miguel Sanchez (University of Granada, Spain)
- Yuval Roichmann (Bar-Ilan University, Israel)
- David Poulshock (Red Door Films)
- Xiang Tang (Washington University, St. Louis)
- Carey Priebe (George Washington University)
- Lowell Abrahms (George Washington University)
- Martin Berggren (Umea, Sweden)
- Fabio Cacciolo (Santa Fe Institute)

## *Graduate Student Highlights*

Congratulations to our three new Ph.D. graduates! **Patricia Cahn** (Vladimir Chernov, advisor) has accepted a postdoc position at the University of Pennsylvania in Philadelphia, PA. Her thesis is titled: "Algebras Counting Self-Intersections of Curves." **Ben Linowitz** (Tom Shemanske, advisor) has accepted a postdoc position at the University of Michigan in Ann Arbor, MI. His thesis is titled: "Selectivity in central simple algebras and isospectrality." **Lola Thompson** (Carl Pomerance, advisor) has accepted a postdoc position at the University of Georgia in Athens, GA, and will begin a tenure track position at Oberlin College in Fall 2013. Her thesis is titled: "Products of distinct cyclotomic polynomials." To read abstracts go to: <http://www.math.dartmouth.edu/graduate-students/theses/>

**Kassie Archer** gave a talk at Permutation Patterns 2012 in Glasgow, Scotland titled "Periodic Patterns of the k-shift and other maps."

**Jonathan Bloom** was recognized as an Outstanding Graduate Student Teacher for his work in Math 3. He spoke at the 2011 Discrete math conference in Burlington (July 2011). He also published two papers: "A Simple Bijective Proof of the Shape-Wilf-Equivalence of the Patterns 231 and 312" co-authored with Dan Saracino, Discrete Math and "A Simple Bijection Between 231-Avoiding and 312-Avoiding Placements" co-authored with Dan Saracino, Journal of Combinatorial Mathematics and Combinatorial Computing.

**Patricia Cahn** was one of the recipients of the 2012 Filene Graduate Teaching Assistant Award. She was also on the organizing committee for Dartmouth's Sonia Kovalevsky Math Day. She gave seminar talks at Brown University and the University of Pennsylvania, and also gave talks at Knots in Washington, the AMS Special Session on Algebraic and Geometric Topology at Cornell University, and the AMS Special Session on Invariants of Knots at the University of Kansas. She attended the program for Women and Mathematics at the Institute for Advanced Study, where she was the teaching assistant for the undergraduate course on Legendrian knot theory.

**Emma Chiappetta** traveled to three conferences in the 2011-2012 academic year. She attended the Joint Math Meetings in Boston, MA, "WIMIN" Conference at Smith College, and the "Workshop for Geometric Structures on Manifolds" in Marburg, Germany.

**Danny Crytser** attended the Great Plains Operator Theory Symposium in Houston, TX (May 2012).

**Elizabeth Gillaspy** attended the Joint Math Meetings in Boston (Jan 2012), the AMS Sectional Meeting in Hawaii (Mar 2012), and the Great Plains Operator Theory Symposium in Houston, TX (May 2012).

**Jennifer Harnish** attended the Discrete Mathematics Conference in Burlington, VT during July of 2011.

**Seth Harris** attended Joint Math Meetings in Boston (Jan 2012) and the New England Recursion and Definability Seminar in Storrs, CT.

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**Katie Kinnaird** attended the International Conference for Machine Learning in Edinburgh, Scotland as well as the 5<sup>th</sup> international workshop on Machine Learning and Music.

In January 2012, **Natasha Komarov** traveled to Berkeley to attend the MSRI workshops “Lattice Models & Combinatorics,” and “Connections for Women: Discrete Lattice Models.”

**Scott LaLonde** was recognized by the Dartmouth Center for the Advancement of Learning (DCAL) as an “Outstanding Graduate Student Teacher” from an undergraduate perspective for his work in Math 1. He also attended the New Hampshire Operator Theory Symposium (NHOTS) at the University of New Hampshire in April 2012, and traveled to the University of Houston for the Great Plains Operator Theory Symposium (GPOTS) in June 2012.

**Asa Levi** traveled to Granada, Spain for the 6th Annual Conference on Lorentzian Geometry (Sept 2011).

**Ben Linowitz** was nominated for the 2012 Hannah Croasdale Graduate Scholar award. He attended a conference on “Computations with Modular Forms” in Heidelberg, Germany and gave talks at several conferences: the 26th Automorphic Forms Workshop held at the University of British Columbia, the Maine-Quebec Number Theory Conference and the Joint Math Meetings in Boston. He also gave invited talks at the University of Georgia’s number theory seminar, at Wesleyan’s algebra seminar and a colloquium at Miami University of Ohio.

**Lola Thompson** won the 2012 Arts and Sciences Graduate Poster Session and was selected to participate in DCAL’s Active Learning Institute. She was invited to give number theory seminar talks at the Pacific Institute for the Mathematical Sciences, Centre de Recherches Mathematiques, University of Washington, Brigham Young University and Brown University. She gave an invited talk on her thesis work in a Special Session on New Perspectives in Analytic Number Theory at the Joint Mathematics Meetings in January. She also spoke at the Integers Conference, West Coast Number Theory Conference, Maine-Quebec Number Theory Conference and Canadian Number Theory Association XII

Conference. Lola attended several workshops over the past year (Women In Numbers 2, AMS MRC workshop on Arithmetic Statistics, Sage Days 33: Women In Sage 2) and served as an organizer for Sage Days 42: Women In Sage 3. Her paper “Polynomials with divisors of every degree” was published in the Journal of Number Theory and her papers “Practical Pretenders” (with Paul Pollack) and “On the divisors of  $x^n-1$  in  $F_p[x]$ ” were accepted for publication in *Publicaciones Mathematicae Debrecen* and the *International Journal of Number Theory*, respectively.

In September we welcomed six incoming students to our Ph.D. Program: **Tim Dwyer** from University of Florida in Gainesville, FL, **Zachary Evans** from Miami University in Oxford, OH, **Michael Firrisa** from University of Maryland in College Park, MD, **Katherine Moore** from Kenyon College in Gambier, OH, **Scott Smedinghoff** from Williams College in Williamstown, MA, and **Everett Sullivan** from Seattle University in Seattle, WA.

### *Alumni News*

If you have news (personal or professional, for example: how you are making use of your math degree) that you would like to have included in the Alumni section of next year’s newsletter, please email Stephanie Kvam ([deptaa@math.dartmouth.edu](mailto:deptaa@math.dartmouth.edu)), Administrative Assistant of the Math Department. Thank you.

### *Sonia Kovalevsky Math Day November 12, 2011*

On November of 2011, we hosted our first annual Sonia Kovalevsky Math Day for high school and middle school girls. The event is part of a national effort, organized by the Association for Women in Mathematics and the National Science Foundation, to encourage young women to continue in mathematics and transition successfully throughout their educations. Since 1985, Sonia Kovalevsky Days have been organized by AWM and institutions all over the country.

The day was a resounding success, with 74 participants and a hefty wait-list. The events included workshops on fractals and the Game of Set, a plenary lecture by Carolyn Gordon, a panel of graduate and undergraduate students discussing their own path through their mathematics education, and a little history

about Kovalevsky herself. An article was published in the September 2012 edition of the Notices (Vol. 59, No. 8), discussing in detail all of the events of the day and some of the wonderful feedback we received.

Many thanks to all the effort put in by organizers Rosa Orellana, Zaij Daugherty, and Patricia Cahn; to the undergraduate and graduate students who designed and facilitated the workshops: Patricia Cahn, Kassie Archer, Elizabeth Gillaspay, Katie Kinnaird, Lola Thompson, Nicole Looper '12, Molly McBride '14, Kellie MacPhee '14 and Emily Eisner '14. The event was funded by Department of Mathematics, the Office of the Dean of Sciences, the Office of the Provost, the AWM, and the NSF.



Professor Daugherty with panel of students

### *NH Operator Theory Symposium*

The New Hampshire Operator Theory Symposium, nicknamed NHOTS, is a day-long event usually held twice a year: once in Hanover at Dartmouth College and once in Durham at University of New Hampshire. The purpose is to bring our two operator algebra groups together, especially to give our graduate students exposure to other ideas and a chance to present their research in a welcoming environment. The group at Dartmouth is led by Jody Trout and Dana Williams. The group at the University of New Hampshire is led by Don Hadwin, Liming Ge and Junhao Shen. We occasionally get participants from colleagues at other local universities as well.

### *Math Majors and Minors*

The number of students choosing to major in mathematics continues to increase. In 2012, 53 Math Majors (up from 41 last year) and 7 Minors graduated. In addition, the following students presented honors theses.

To read abstracts go to:

<https://www.math.dartmouth.edu/undergraduate/honors/>

- **Philip Winsor '12** (Dan Rockmore, advisor) "The Spectral Structure of the Credit Default Swap Market"
- **Hee-Sung Yang '12** (Carl Pomerance, advisor) "Unitary Untouchable Numbers"
- **Andrew Cala '12** (Peter Doyle, advisor) "Optimal Betting for Fixpoint Solitaire"
- **Gregory Elliot '12** (Vladimir Chernov, advisor) "On the Connected Sum of Alternating Virtual Knots"
- **Paul Lintilhac '12** (Eugene Demidenko, advisor) "Several Strategies to Cope with Negative Weights in the Optimal Portfolio Allocation and their Implementation"

Dorothy Wallace organized the first Undergraduate Math Poster Session which took place on May 29, 2012. Two full hallways of Kemeny Hall were lined with more than 30 posters from over 50 students. The posters covered a wide variety of math topics. Some were made as end projects for a class, others as a capstone for research. The three winners of this year's competition were:

- *First Place:* **Bradley Nelson '12** for his poster "Boundary Methods for Variable Coefficient Helmholtz Boundary Value Problems"
- *Second Place:* **Anna Morenz '12** for her poster "Reading with new eyes: Single word network analysis of the representation of biofuels in contemporary media"
- *Third Place:* **Philip Winsor '12** for his poster "The Spectral Structure of the Credit Default Swap Market"

Other undergraduate news:

**Emily Eisner '14**, advisor: Rosa Orellana, an undergraduate math major, was the youngest speaker at this year's Nebraska Conference for Undergraduate Women in Mathematics. She received funding from the Neukom Institute. Her research was funded by a Sophomore Fellowship.

**Bradley Nelson '13**, full-time leave-term research, advisor: Alex Barnett, "Integral equations for graded media," funded by Richter grant (Spring 2012).

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**Hanh Nguyen '14**, Sophomore Science Scholar (Fall 2011)

**Philip Winsor '12** received the 2012 Senior Thesis Presentation Award.

**Hee-Sung Yang '12** was awarded the Gazzaniga Family Science Award by Dartmouth College for the best undergraduate research in the sciences for the 2011-12 academic year. He is now enrolled in the PhD Mathematics program at UCLA.

### *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:

- **Vipul Kakkad '13** (Alex Barnett, advisor) "Optimization of bell mode frequencies"
- **Noah Lebowitz-Lockard '13** (Peter Doyle, advisor) "Involutions On Dyck Paths"
- **Elaine Levey '13** (Sergi Elizalde, advisor) "Forbidden patterns in financial time series"
- **Cecil Qiu '13** (Peter Doyle, advisor) "Reconstruction of Bernstein's Division Theorem"
- **Priya Shanmugam '13** (Dorothy Wallace, advisor) "Integration of the Larval Habitat into Differential Equation Models of Malarial Spread"
- **Taylor Sipple '13** (Alex Barnett, advisor) "Laplacian Eigenvalue Solutions"
- **Joseph Tanenbaum '13** (Dorothy Wallace, advisor) "Revisiting Modeling in Ventricular Myocytes"

### *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 with an emphasis on women in their first year.

In the Winter 2012 and Spring 2012 terms three WISP interns worked on research projects in the Mathematics Department. **Katherine LaChance '15** and **Shelby Schrier '15** worked with Professor Emeritus Bob Norman on the project "Comparing Voting Systems," **Xinyue Guo '14** worked with Professor Dorothy Wallace on the project "Modeling biological systems through systems of ordinary differential equations."

WISP interns typically work in their winter and spring terms which end 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. This year's symposium featured a keynote address by Dr. Mary Lou Guerinot on "Metals, Mutants and Mayhem." Professor Emeritus Bob Norman received an award for being a WISP sponsor for 20 years, with the added distinction of mentoring the most students.



Kathy Weaver, Director of WISP, presenting an award to Professor Emeritus Bob Norman.

[Photo courtesy of Flying Squirrel Graphics]

### *Association for Women in Mathematics*

<http://www.math.dartmouth.edu/~awm/>

The Association for Women in Mathematics encourages women to pursue their interests in mathematics. An enthusiastic group of women students in the Dartmouth student chapter enjoyed weekly meetings and monthly lunches or dinners with mathematics professors. The chapter also paired

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students with “lunch buddies” to build further camaraderie and encourage each other’s interests.

The chapter held special events, including a delightful lecture by Elizabeth McMahon of Lafayette College on the mathematics of the game of Set. Several members of the chapter led workshops at Dartmouth’s Sonya Kovalevsky Mathematics Day for high school girls.

Professors Rosa Orellana and Carolyn Gordon serve as co-advisors.

### *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 2011-12 academic year the Executive Board of the Math Society was: President: **Jun Chen** ’12 (Fall) and **Noah Lebowitz-Lockard** ’13 (Winter, Spring); Vice president: **Noah Lebowitz-Lockard** ’13 (Fall) and **Nicole Looper** ’12 (Spring); Treasurer: **Nicole Looper** ’12 (Fall) and **Sean Griffin** ’14 (Winter and Spring). The faculty advisors for the DMS were Professors Rosa Orellana and Vladimir Chernov.

Listed below were some of the activities of the DMS for the 2011-2012 academic year:

Talks by Mathematics Department regular and visiting faculty:

- Professor **Vladimir Chernov** “Causality and causally simple spacetimes,” Oct 10, 2011
- Professor **Peter Doyle** “1986: the year of the pentagon,” Oct 24, 2011
- Professor **Andrew Yang** “A brief introduction to Sage,” Oct 31, 2011
- Professor **Alex Barnett** “The fast Fourier transform: an algorithm that has changed your life,” Nov 7, 2011
- **Bob Drake** “The Stupid Number(s): A Folk Mathematical Adventure,” Feb 6, 2012
- Professor **Rosa Orellana** “From Braids to Knots: An introduction to representation theory,” Feb 20, 2012

- Professor **Vladimir Chernov** “Refocusing of light rays in spacetimes,” April 18, 2012
- Professor **Craig Sutton** “Vibrating drums, Cayley graphs and isospectral surfaces,” May 2, 2012
- Professor **Carl Pomerance** “Sums and products,” May 16, 2012
- Professor **Carl Pomerance** “Seeing Stars,” Aug 8, 2012

Talks by our undergraduate students:

- **Emily Eisner** ’14 “A Turning Class Algebra for Sign Permutations,” Jan 23, 2012

Talks by Dartmouth alumni:

- **Paul Kinson** ’81, Liscord, Ward & Roy Inc., “I want to be an actuary!” Feb 21, 2011

### *Thayer Mathematics Exam*

The Thayer Prize Mathematical Exam is an annual tradition for the Mathematics Department. It was made possible by a gift from General Sylvanus Thayer class of 1807, the founder of the Thayer School of Engineering at Dartmouth. The purpose of the gift was “to constitute a perpetual prize fund for superior proficiency in the higher branches of Mathematics...” The first prize was awarded in 1866. It is one of the oldest such prizes in continuous existence.

The exam gives first-year students a chance 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.

2012 Winners

**Jesse Selover** ’15, First Place  
**Ha Nguyen** ’15, Second Place  
**Ajay Kanna** ’15, Third Place

### *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 8 math minors: Mathematics, Applied Mathematics for Physical and Engineering Sciences, Applied Mathematics for Biological and Social

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Sciences, Mathematical Biology, Mathematical Logic, Mathematical Physics, Mathematical Finance, and Complex Systems. We also have three modified math majors: Mathematics Modified with Biology, Modified Major in Mathematics with Philosophy, and Modified Major for Complex Systems.

Seven 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. The course was taught by Professors Rosa Orellana and Alex Barnett. Occasionally students from outside our department have taken the course, and we have recently formalized this option. This year’s class, **Ian Adelstein, Jonathan Bloom, Megan Ehresmann, Jennifer Harnish, Nathan McNew, Sarah Wolff, and Lin Zhao** chose to focus on “A Dynamic View to our Chaotic Reality” and “The Algebra of Symmetries” 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 Mathematics” camps for local middle and high school students. Over 20 local participants attended each of the two sessions, coming from Hanover, Norwich, Lebanon, Etna, Lyme, White River Junction, Grantham, Hartland, Claremont, Meriden, Thetford, Orford, Goshen, Somersworth, and Strafford.

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.

### *Digital Library for Alumni*

<http://www.dartmouth.edu/~library/alumni/>

Alumni are welcome to use the all of the Library resources, both print and online, whenever you are on

campus. If you live in the Upper Valley area and visit our libraries in person, you can register for borrowing privileges from the Library’s circulating collections. Even if you don’t have the opportunity to visit campus, many of our collections and services are open to you.

Our Alumni Digital Library allows you remote access to ProQuest ABI Inform Global, JSTOR backfiles, Project Muse eJournals & eBooks and many more. Some of the resources linked on the Alumni site are freely available and some require authentication with your NetID. Just a few highlights from the Project Muse collection include the ebooks [The Aha! Moment: A Scientist's Take on Creativity](#) by David E. H. Jones, and [How to Guard an Art Gallery and Other Discrete Mathematical Adventures](#) by T. S. Michael, as well as current access to American Journal of Mathematics.

If you have any questions, please contact Ann Perbohner, the reference librarian for the Cook Mathematics and Computer Science Collection ([Ann.Perbohner@Dartmouth.edu](mailto:Ann.Perbohner@Dartmouth.edu) or 603-646-3845). Ann attended the MSRI workshop on Journals in Mathematics in Berkeley (Feb 2011) and the Joint Math Meetings in Boston (Jan 2012). At JMM, Ann participated in the poetry open mic. In this past year, Ann has had poetry published in *Bloodroot*, *Lifelines*, *Poetry Cram*, and elsewhere.