
MATH MATTERS

DEPARTMENT OF MATHEMATICS CORNELL UNIVERSITY ITHACA NY NOVEMBER 2009

LETTER FROM THE CHAIR, LAURENT SALOFF-COSTE

The department changed Chairs on July 1, and I would like to thank Dan Barbasch for his service to the department and for helping me transition into this new responsibility. The past year saw a flurry of successful scientific activities, some of which we discuss in this newsletter. As the great recession fell upon us, it brought a series of serious budget cuts to Cornell in general and the department in particular. The most visible direct effect of the cuts so far include a reduced staff, a smaller number of visitors, somewhat higher class caps, and the passage of some entry-level courses from small- to large-lecture format. We will continue to work hard to deliver a varied curriculum in an efficient manner to serve the needs of our undergraduate and graduate students.

In a difficult environment where our College cancelled a number of searches, we were able to hire Tim Riley, a topologist working in geometric group theory.

Three colleagues from the former Theoretical & Applied Mechanics Department – Tim Healey, Richard Rand, and Steve Strogatz – now hold joint appointments in the Departments of Mechanical and Aerospace Engineering and in Mathematics.

Effective July 1, Irena Peeva was promoted to full professor, and Tara Holm and Ed Swartz were promoted to associate professors with tenure.

The third recipient of the Michler fellowship is Maria (Masha) Gordina

of the University of Connecticut where she is an Associate Professor. Masha received her Ph.D. in 1998 from Cornell and will join us in Spring 2010.

This year's Chelluri lecturer was our colleague Saul Teukolsky of Physics and Astronomy Departments; he spoke on Einstein's Equations, Black Holes, and Gravitational Waves. The Kieval Lecturer was Keith Devlin from Stanford University, also known as NPR's "Math Guy". His lecture "Using Mathematics to Solve Life's Mysteries" was delivered to a packed Bache Auditorium and addressed questions such as: What really keeps an airplane in the sky?, and Why does a skateboard leave the ground when its rider executes a jump?

This fall also saw the first edition of the Evans Lecture Series. Christopher Skinner from Princeton gave two fascinating but accessible lectures on number theory: The Saga of 691 and Special Value Formulas. This was a great start to a new tradition. If you are curious about the name given to this Lecture Series, see the explanation on our web site.

As the number of visitors supported by teaching funds is reduced, we are able to launch a new program supported by the Twiss Math Faculty Research Fund. These funds will provide support to visitors who collaborate with faculty members and interact with graduate students for periods of 2 to 8 weeks.

These awards are made possible through a generous gift of Kirk Twiss '78.

In February, we learned that Marek Biskup would not be joining us after all. This put our renowned probability group in a precarious situation. Then in September, and after 25 years in the Department, Rick Durrett accepted an offer from Duke where he will move next summer. Eugene Dynkin will retire July 1, 2010, after spending more than 30 years here. Reinventing probability at Cornell will be an interesting challenge for the coming years.

I want to extend our thanks to Kay Wagner, who served as Acting Director of the Math Support Center last year. Maria Terrell, Senior Lecturer and Director of Teaching Assistant Programs, is now the MSC Director.

Long-time staff member Donna Smith retired after almost 29 years at Cornell and 11 years in our department. She was our graduate field coordinator and the organizer of many great social functions for us, and we miss her.

Finally, it is with a mixture of both happiness and regret that I must report we are losing our long-term editor of *Math Matters*, Cathy Stevens. Cathy has worked in the department for over 40 years. We are happy for her and wish her all the best in her retirement, but we will all miss her and the many contributions she has made to the department.

HONORS, AWARDS, NOTABLES

Lou Billera and **Justin Moore** are invited speakers at the 2010 International Congress of Mathematicians, to be held August 19-27 in Hyderabad, India. See <http://www.icm2010.org.in/speakers.php>.

Last spring **Rick Durrett**, a world-renowned probabilist, was interviewed for a feature article that appeared in the Japanese Graphic Science magazine called *Newton*. This magazine is published monthly and written for the general reader in Japan. The interview was a very broad discussion covering several topics and issues in the field of probability and its application to such diverse areas as genetics, medicine, economics, gaming theory, voter behavior, etc. The magazine website is: <http://www.newtonpress.co.jp>.

Martin Kassabov received the prestigious von Neumann fellowship from the Institute for Advanced Studies where he will spend a good part of this semester.

Antonio Montalban (Ph.D. 2005) won an AMS Centennial Fellowship (<http://www.ams.org/prizes/centennial-fellowship.html>).

Richard Rand won a Weiss Presidential Fellowship “for excellence in teaching and advising undergraduate students and outstanding efforts to improve instruction on campus”. See the announcement in <http://www.news.cornell.edu/stories/Jan09/WeissFellows.sl.html>.

Richard Shore was the 2009 Göedel Lecturer (<http://www.aslonline.org/info-prizes.html>) of the Association for Symbolic Logic.

The Calculus of Friendship by **Steven Strogatz** was published in August 2009 by Princeton University Press - <http://press.princeton.edu/titles/8859.html>. This book tells the story about the special relationship he and his high school teacher had for over 30 years. Steve will be speaking about this story at the joint Mathematics Meetings in San Francisco on January 16, 2010.

As is now a tradition, the Department Teaching Awards for 2008-09 were announced during our popular winter holiday party in December. **Ken Brown** and **John Hubbard** were the recipients of our Senior Faculty Teaching Award. **Geoffrey Recktenwald** and **Alexander Vladimirsky** received the Junior Faculty Teaching Award.

Among the graduate students, **Fatima Mahmood** and **Artem Pulemotov** received the Department Teaching Award, and **Artem Pulemotov** and **Zhigen Zhao** shared

the Battig Award. The Hutchinson Award went to **Saúl Blanco Rodríguez** and **Jennifer Biermann**, and **Igors Gorbovickis** received the York Award.

Two Cornell teams did very well this year in the **Mathematical Contest in Modeling!** One of our teams – Amrish Deshmukh, Matthew Guay, and Rudolf Nikolaus Stahl – placed in the top nine out of 1,675 teams from 13 countries. Their manuscript was designated “Outstanding”. They modeled the energy consumption issues associated with the predominant use of traditional land-line phones versus cellular phones and the transition from the former to the latter.

Another MCM Cornell team – Stephen Demjanenko, Joshua Edgerton, and Jesse Livezey – attacked the problem of optimal design and management of traffic circles. Their solution was designated “Meritorious”, placing them in the top 18% of all participants.

* * * * *

PROBABILITY SUMMER SCHOOL

by Rick Durrett

The 5th Cornell Probability Summer School, supported by a Research Training Group grant from the National Science Foundation to the probability group, was held July 6-17, 2009. It featured a six-lecture series by Ander Holroyd “Matching, coupling, and point processes”, Robin Pemantle “Probability from generating functions”, and Yuval Peres “Aspects of Markov chains”. In addition, rising stars Rick Kenyon, Scott Sheffield, and Balint Virag each

gave two lectures. This talented list of speakers attracted a large crowd of participants – 85 were chosen to attend among 120 who applied. The 6th Summer School to be held July 19-30, 2010, will feature lectures by Martin Barlow, Bruce Driver, and Alexander Grigoryan on the topic of heat kernels. If you can’t wait until summer, there will be a conference in honor of Len Gross April 11-13, 2010, which will feature many of the same themes.

RESEARCH EXPERIENCES FOR UNDERGRADUATES

by Robert Strichartz (Director)

The National Science Foundation has supported our program for 15 years. Seventeen talented undergraduates worked on significant and interesting research problems in one of three areas in 2009: **Analysis on Fractals**, led by Bob Strichartz with graduate student Jason Anema, **Games and Automata** led by Sasha Rubin (Visitor) with graduate student James Worthington, and **Groups via Actions** led by Collin Bleak (Nebraska-Lincoln) with graduate student Juan Alonso

Students in **Analysis on Fractals** investigated the analogs of differential equations on fractal spaces. Three of the students continued the development of this area when the underlying space is a quadratic Julia set following up work of Taryn Flock (REU 2008). Stella Dong (NYU Poly Inst) and Zheyuan Hu (Mount Holyoke) analyzed new examples of Julia sets including the airplane, a dendrite, and the Basilica-in-Rabbit, while Tarik Aougab (Penn) studied covering spaces of the Basilica. Julia sets have been studied as examples in complex dynamics at Cornell for many years, but the study of different equations on Julia sets is just being developed, building on research of Luke Rogers (former postdoc; Connecticut) and Alexander Teplyaev (former grad student). Justin Owen (Harriet L. Wilks Honors College) studied boundary value problems on domains in the Sierpinski gasket (SG), and Kaitlyn Tuley (Maryland) studied orthogonal polynomials on SG. **Matthew Guay** (Cornell) studied a family of fractals SG_n generalizing SG with the property that the limit as n goes to infinity, the fractals approximate an

equilateral triangle. Matt showed that the spectrum of the fractal Laplacian converges to the spectrum of the ordinary Laplacian on the triangle, which is known explicitly, by showing that a discrete approximation to the fractal Laplacian is very close to a finite difference approximation to the ordinary Laplacian on the triangle. Luke Rogers assisted him in this work.

Games and Automata students broke into two groups and worked on questions from theoretical computer science. Alex Kruckman (Brown), **John Sheridan** (Cornell), and Ben Zax (Caltech) worked on word and tree automata with advice tapes. They extended a classical characterization of automata due to Myhill and Nerode (Cornell faculty) and found applications to automatic ordinals. John and Ben presented their work in the Cornell logic seminar, and John presented at the Mid-Hudson Mathematics Conference for Undergraduates at Bard College. Andrey Grinshpun (CMU), **Pakawat Phalitnonkiat** (Cornell), and Andrei Tarfulea (Chicago) worked on parity games – certain two-player games of perfect information with infinite plays that have applications to logic and verification. The outstanding problem in this area is whether solving parity games (i.e., deciding which player has a winner strategy) can be done in polynomial time. They introduced the trap-depth of a game that, loosely, measures to what extent the players can beneficially trap their opponents in regions of the graph. They found a polynomial time algorithm for solving games of depth

one. The complexity for higher depth is still open.

Groups via Actions students worked primarily on two projects. The first one was a study of higher dimensional piecewise linear actions on n -manifolds. Stefan Froelich (Georgia Inst Tech), Ben Krause (Amherst), Martin Kassabov (faculty), and Collin Bleak worked together. They were able to show that if Z^{n+1} acted faithfully on an n -cube in a PL fashion, fixing the points on the boundary, then the orbit of any point in the interior was completely determined by the action of some Z^n subgroup. The other project investigated the properties of Prof. Thurston's Piecewise Integral Projective groups (PIP_n). PIP_n is a particular group of homeomorphisms of the standard n -simplex. This project was driven primarily by the work of Kerstin Baer (Bryn Mawr), **Vaikath Job** (Cornell), Ben Passer (Missouri U. of Science and Technology), Juan Alonso, and Collin Bleak. Job is currently writing out the results, which go some way towards drawing structural similarities between the PIP groups and the R. Thompson group F . In particular, they found a subgroup $PIPI_n$ which appears to have many properties similar to the first derived group of F . The goal is to show that $PIPI_n$ is simple and finitely presented. This work is ongoing by the team.

The projects that are planned for Summer 2010 will be Analysis on Fractals (Bob Strichartz), Geometric Differential Equations (Xiaodong Cao), and Optimality and Uncertainty (Alex Vladimirovsky).

www.math.cornell.edu

A SURPRISE WHILE SWITCHING FROM SMALL TO LARGE LECTURES USING BEAMER

by Allen Back

The news that I'd be teaching an introductory statistics lecture to 100 students instead of 30 was not too positive. I discovered by accident some real benefits using the natural tools for the new format! Having taught the course 15 to 20 times, I had a comfortable style mixing transparency and blackboard with a bit of computer. Dan Barbasch rightly pointed out that it would not be hard to transfer my existing style to a larger group. He also recommended adding some jokes. Having limited skills as a humorist, I expected student satisfaction levels to take a big hit due to less ability to hone in on individual questions.

To give the new format a fighting chance, I decided to switch to Beamer, the powerpoint-like package for LaTeX. Department members use Beamer or a sibling for occasional talks, but I don't think it's penetrated our regular teaching much. Most academic disciplines use powerpoint, so our students are used to it.

My first challenge was to actually learn Beamer, so I read the Beamer chapter of George Graetzer's "More Math into LaTeX". After a few hours one Saturday afternoon, it was easy to get basic effects going, and I was able to run Beamer on the four platforms I regularly use: A Linux box in my office, a Mac mini at home, as well as a windows machine running Cygwin, and the 2-pound Asus Linux netbook I use for presentations.

It took a little longer to become comfortable with the GIMP for editing pictures, but Akkana Peck's book helped me get past that fairly quickly, and I could also run that everywhere. Having taught the course so much, I

had a big library of existing examples and ideas, most already in electronic format.

Now to some of the surprises. One big one was how easy it was to work with students on the step-by-step development of the graphs! In a blackboard environment, you often try to communicate that to students, but no matter how well you hold their interest, it's hard for them to review the details unless they completely caught it when you first explained it.

However, with the handy GIMP at your side, you just save the intermediate stages, drawing arrows, annotating with text, and using colors. Then in Beamer it's easy to present this in step-by-step fashion. Beamer files are normally converted to pdf, so there is no problem posting the results of your lectures on your course web site where students can review any of the step-by-step developments they didn't totally grasp in class.

Another surprise was coverage of material. Beamer is famous for letting people go too fast. But if you have all the computational details in the pdf that the students can immediately review, you don't need to spend a lot of time during class carrying out the arithmetic. Instead, you concentrate more on the structure and interesting aspects while still meeting the student interest in complete details by referring them to the carefully written pdf file.

I also discovered I could incorporate many more of my "bright ideas" of past semesters than usual. Each semester I'd have some new notion, but it would tend to crowd out some older stuff. I couldn't fit in new ideas I got from Dave Bock,

Michael Nussbaum, Gene Hwang, or the web. Good ideas, but in the end, I'd have to invoke the old "for good health, time to move on" rule. In this format, I find that I can put many of these ideas in by sketching what is of interest during class and allowing students to look more if they wish.

I occasionally spend a few minutes "above the exam level", offering a slide proving some key result (such as the variance of a sum of random variables result which lies at the heart of about a third of the formulas in the course). Now I spend the same few minutes pointing to a complete step-by-step argument, and students can peruse more if interested. While the prerequisite of the course is high school algebra, the majority of the class are strong students who've taken calculus and need statistics. Perhaps only 10% are interested in the complete details, but quite a few appreciate having some idea of where things come from, as long as they don't have to spend too much time on that aspect.

Math 1710 is probably an easier case than many courses for this treatment. It thrives on richer examples than you can quickly write on the blackboard. The computational content is quite modest in contrast to our other courses; one of my favorite references consists of 20 case studies that originated as a one-week boot camp in statistics for incoming Wharton School MBA students, so six weeks during the summer or 14 weeks during the semester are no problem. It may well be that a lot of the plusses can also be harvested in some of our other courses that are heading to larger sizes. We may want to find out!

SUMMER MATH INSTITUTE (SMI)

by Ken Brown (2009 Director)

SMI has been held since 2006, with support from the National Science Foundation starting in 2008. SMI's objective is to better prepare undergraduate women and underrepresented minorities for the rigors of doctoral programs. The focal point is a course taught at the level of our undergraduate honors courses, alternating between analysis and algebra; analysis will be offered in 2010. Students also do research projects.

Eleven students attended in 2009: Sarah Anderson (Presbyterian Coll), Alex Barrios (Miami Dade), Osman Chaudhary (Millersville), Cory Colbert (Virginia Commonwealth), Chris Knapp (Kent State), Allison (Alli) Louie (Emory), Tori Pierce (Missouri), Jamie Rahr (Niagara), Laura Strube (Texas at Tyler), Eteri Svanidze (Fredonia), and Liz Vidaurre (Rochester).

Jason Boynton (ND State) taught the algebra course, and Matt Noonan supervised the research projects. Kristine Jones Fisher and Tia Sondjaja were the TAs, and Denise Terry Dawson and Huimei Delgado (SMI '06) coordinated activities for the students. Students worked on three research projects: "Combinatorial bijections", "Investigation of the Loewner trace", and "Minimal surfaces in four dimensions".

Four students attended the Society for Advancement of Chicanos and Native Americans in Science Conference in October and gave poster presentations based on their research. Cory and Laura received "Outstanding research in mathematics awards" for their presentations. Cory also won the "Who wants to be a mathematician" contest.

Now I will share some news about our SMI alumni. We are

pleased to report that 24 alum are currently in graduate school. Ashley Crump ('06, now at Princeton) recently won a Ford Foundation fellowship. Jaret Flores ('06, now at Rutgers), Kevin Mugo ('06, now at Purdue), and Shannon Talbott ('06, now at Iowa) all passed their qualifying exams. Amanda Taylor ('07, now at Binghamton) earned her Masters' Degree.



Back row: Alex, Matt, Laura, Chris, Jason, Cory, Eteri, Osman, & Ken; front row: Kristine, Tia, Alli, Sarah, Tori, Liz, Jamie, & Huimei

A PUZZLE FOR YOU!

ALGEBRA (الجبّر) ALGEBRA

$Y/Z=1/x$		$Y^2-Z^3=0$
$Y-xZ=0$		$Y+Z=1+x$
$Y^2=Z$	x^3	$Y-(xZ)^2=0$
	$Y-Z^2=x^3-1$	x

Each row and column should contain a permutation of $\{1, x, x^2, x^3\}$. The equation in the upper left corner of each cage (heavily outlined box) must hold when the cage entries are substituted for the variables Y and Z in some order, except that single-box cages are freebies.

K-12 EDUCATION & OUTREACH ACTIVITIES

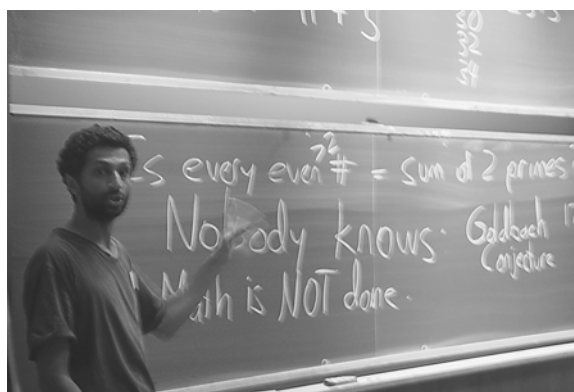
by Rick Durrett & Mary Ann Huntley

We continued our tradition of providing support to the local community in a variety of outreach activities, some of which are discussed below.

The Rural Schools Mathematics Tutoring Program, created by Dan Barbasch during his term as Chair, provides after-school tutoring once a week to neighboring schools in Tompkins County. In 2008-09, volunteers – faculty Dan Barbasch and Michael Morley, graduate student Corinne Sheridan, and twelve undergraduates majoring in the sciences – tutored at Groton High School and Newfield Middle School. This fall, students at The George Junior Republic, Lansing School, and Newfield Middle School are receiving tutoring. Volunteers include Michael Morley, graduate student Marisa Belk, and ten undergraduates including math major Richard Craib. When asked what he hopes to gain by participating in this program, he responded: “I learn a lot about mathematics by teaching it. Communicating technical ideas is a really important skill. I am originally from South Africa, and I used to tutor mathematics there; I actually founded a small charity to teach underprivileged kids. I am excited to use this experience in the US.”

Each semester we host full-day workshops for secondary mathematics teachers (MATH 5080). Together with the Center for Applied Mathematics and Johns Hopkins University’s Center for Talented Youth, we hosted a program for grades 7-10 students and their parents/guardians on October 24. Most of the 90 participants came from New York, but others came from Pennsylvania, New Jersey, Maryland, Connecticut, Rhode Island, and Vermont. Steve Strogatz (CAM/Math/TAM) discussed the simplest mathematical model of collective synchronization and showed videos of

synchronous fireflies and London’s wobbly Millennium Bridge. Breakout sessions allowed participants to learn more about these phenomena and other mathematical concepts by engaging in hands-on activities. The breakout sessions were organized and led by graduate students Anna Bertiger, Jennifer Biermann, Nathan Karst, Tim Novikoff, and Chris Scheper. Other graduate students who participated were Marisa Belk, Diarmuid Cahalane, Matt Holden, Sam Kolins, Ben Lundell, Seth Marvel, Joel Nishimura, and Katie Sullivan. Undergraduates from the Math Club helped facilitate the breakout sessions. Ravi Ramakrishna (Math)



Ravi Ramakrishna

concluded the day’s events with a discussion of the 350-year history of Fermat’s Last Theorem.

Although the funding from our NSF grant will be ending soon, graduate students being supported by the grant have worked hard, producing additional materials for our **Math Explorer’s Club** collection (<http://www.math.cornell.edu/~mec/>) and for the TV show **Numb3rs** (<http://www.math.cornell.edu/~numb3rs/>). There are 43 MEC modules covering a wide variety of topics accessible to high school students, and **Numb3rs** is completed through the end of season 5.

Putting our materials in the hands of high school students is our final challenge. There are links to our

materials on the AMS web site. Gwyn Whieldon went to a workshop at MSRI on their Math Circles program and reports, “The conference was really fun, and people were VERY interested in the materials that were developed. I had about fifteen people attend the talk that I gave, all of whom were interested in possibly integrating our materials into their various math circles.” To complement the online materials, Ben Lundell is leading an effort to make a book on topics from our MEC collection. Chapters will be written by Jason Anema, Jennifer Biermann, Saul Blanco-Rodriguez, Chris Cunningham, Peter Luthy, Russ Thompson, and Gwyn Whieldon.

Graduate students Anna Bertiger, Kathryn Lindsey, Jenna Rajchgot, Corinne Sheridan, and Tianyi Zheng went to Boynton Middle School for their Math Day, May 6. Students visited their table throughout the day to have fun with solving KenKen puzzles. Anna reports: “Math day was an interesting experience. We had students

from wildly different backgrounds over the course of the day, so each period was a new adventure in terms of what material we would get to and what sort of discussions we would have with students. I like to think that a number of students from all of the different groups learned something about factoring and the like and had a good time.”

* * * * *

Please contact us, and give us some news!
mathmail@cornell.edu

THE CLASS OF 2009

MATH MAJORS

Forty majors (including four in January) received Bachelor of Arts degrees this year. Honors were awarded to eleven of our majors:

Summa Cum Laude

Kai Fong Ernest Chong
Steven Heilman
Wei Quan Julius Poh
Miles Wheeler

Magna Cum Laude

Hannah Newfield-Plunkett
Rudolf Nikolaus Stahl

Cum Laude

Michele Lynne Esposito
Jeffrey James King
Heqing Li
Yuriy A Pyzhik
Christina Diane Zlogar

* * * * *

HARRY S. KIEVAL PRIZE

The *Kieval Prize* is given to an outstanding undergraduate major annually. This year, it was awarded jointly to **Steven Heilman** and **Wei Quan Julius Poh**.

The **Putnam Exam** is held annually in early December. Cornell's 2008 team – Julius Poh, Matt Weinberg, and Ernest Chong – placed 16th in the nation.

This year, the Putnam Exam, which is a 6-hour, 12 problem test, will be given on Saturday, December 5th. Cornell will be represented by Zheng Kang Tham, Matt Weinberg, and Pakawat Phalitnonkiat.

GRADUATE STUDENTS AWARDED PH.D.'S

Joshua Bowman, *Flat Structures and Complex Structures in Teichmüller Theory*, August.

Nikolai Dimitrov, *Rapid Evolution of Complex Limit Cycles*, August.

Alimjon Eshmatov, *Group-Valued Implosion and Conjugation Spaces*, August.

Bradley Forrest, *Degree Subcomplexes of Auter Space and Ribbon Graph Complexes*, May.

Chris Lipa, *Monodromy and Hénon Mappings*, August.

Radu Murgescu, *On the p -Class Groups of the Pure Number Field $Q(N^{1/p})$ and its Galois Closure $Q(N^{1/p}, \alpha_p)$* , January.

Jonathan Needleman, *On Branching Laws for Representations of $GL_4(F)$ to $SP_4(F)$* , August.

Artem Pulemotov, *Geometric Flows on Manifolds with Boundary*, August.

Biao Wang, *Foliations for Quasi-Fuchsian 3-Manifolds*, August.

James Worthington, *Automata, Representations, and Proofs*, August.

Zhigen Zhao, *Decision Approach and Shrinkage Confidence Intervals*, August.

(Answer to puzzle from p. 5.)

1	x	x ²	x ³
x ³	x ²	x	1
x	x ³	1	x ²
x ²	1	x ³	x

Math Matters is published through the combined efforts of members of the department. Many thanks to Allen Back, Ken Brown, Rick Durrett, Bill Gilligan, Katie Huber, Mary Ann Huntley, Joy Jones, Michelle Klinger, Heather Peterson, Laurent Saloff-Coste, Brenda Smith, Bob Strichartz, and Alex Vladimirsky for their contributions.

I am retiring on January 7, 2010. My life is enriched because of everyone I've met throughout the years, and I want to bid a fond farewell to all of my friends.

Catherine Stevens, Editor (cls15@cornell.edu)

MATHEMATICS DEPARTMENT ENDOWMENTS & GIFTS

We are grateful to alumni, friends, and family for their generosity in supporting our endowments or providing other gifts and donations to the department.

The **Ruth I. Michler Memorial Prize**, established by Gerhard and Waltraud Michler of Essen, Germany, in memory of their daughter, provides funding for the Ruth I. Michler Memorial Prize of the Association for Women in Mathematics. The awardee spends a semester here without teaching obligations.

The **Chelluri Lecture Series** was established by Raju Chelluri's parents in his memory. Funds are used to invite distinguished mathematicians to give annual lectures.

The **Michael D. Morley Senior Prize in Mathematics** is presented annually to an Ithaca High School student who has excelled in mathematics and who has demonstrated originality and innovative power in mathematics.

Teaching Awards for Graduate Students and faculty were created in 2001. Prizes are awarded to graduate students.

The **Colloquium Endowment Fund** was instituted to invite distinguished scientists to speak at the Oliver Club seminars. (See www.math.cornell.edu/~oliver/.)

The **Eleanor Norton York Endowment** was established in honor of Eleanor Norton York to recognize outstanding graduate students in both Astronomy and Mathematics. The

income from this endowment is used to provide annual prizes to a continuing graduate student.

The **Faculty Book Endowment** is dedicated to the goal of providing the Cornell community with immediate access to one of the world's finest collections of mathematics books and publications.

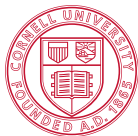
The **Israel Berstein Memorial Fund** was established in honor of Israel Berstein, a professor in this department from 1962-1991. The memorial fund is intended to help young mathematicians in the field of topology.

The **Logic Endowment** was started with a generous gift from a former Cornell undergraduate. This endowment seeks to actively support promising logic students.

The **Robert John Battig Endowment** was established by his parents after his untimely death. Robert was awarded a January 1998 Ph.D. in mathematics. The fund provides an annual prize to an outstanding continuing graduate student in mathematics at Cornell.

If you would like to contribute, please make your check payable to Cornell University, indicate the endowment, or that it is a gift in support of Mathematics, and send it to:

Department of Mathematics Endowments & Gifts
310 Malott Hall, Cornell University
Ithaca, NY 14853-4201



Cornell University
Department of Mathematics

310 Malott Hall
Ithaca, NY 14853-4201
