ContinuUM

Newsletter of the Department of Mathematics at the University of Michigan 2008

View from the Chair's Office

Tony Bloch

This has been a busy year for the Department of Mathematics. The year was mostly upbeat and filled with interesting mathematical occasions. Unfortunately, however, we were saddened by the tragic loss of our esteemed colleague and good friend, Juha Heinonen, and we mourn the passing of our much loved and admired emeritus professor, Wilfred Kaplan.

During this past academic year we had 21 visiting scholars and faculty members playing an active role within the Department, and more than 160 short-term visitors. In addition, our own faculty members presented numerous lectures at venues throughout the USA and all over the world.

We had an excellent colloquium series. We also enjoyed two superb lecture series, one on Hyperbolic Dynamics by Curt McMullen and the other on Complex Manifolds by Gang Tian. In addition, our Department members organized numerous conferences on various subjects, including a wonderful conference in honor of Juha Heinonen. An exciting conference in honor of the 65th birthday of Mel Hochster, our new Department Chair, was held in August.

We have a remarkable faculty who continue to be recognized both internally and externally. The Math Department has 62 regular tenured/tenure-track members, 5 non-tenure-track members, and 53 three-year post-graduate positions. We are pleased to have hired Professor Roman Vershynin who joined us from UC Davis.

One measure of our excellence is that our faculty members currently hold more than 91 federal grants for their research. Several of our faculty have received distinguished honors, the details of which can be found on page 4. Hy Bass was named a Distinguished University Professor, the highest honor bestowed upon faculty by the UM. We are proud that the Department now boasts two such professorships. As a result of the strength of our faculty, we continue to face intense outside pressure in the form of external recruitment attempts. I am happy to report that we continue to succeed in retaining most of our excellent faculty.

Our student body this year comprises 143 graduate students and approximately 415 math concentrators. In the fall 2007 term 7,353 students were enrolled in math courses. In the winter term there were 5,298 such students. We graduated 133 undergraduate math majors this year, and 31 new graduate students will be starting their degrees in the fall of 2008. There are many outstanding

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Mel Hochster Named New Chair

It is exciting for me to have the chance to serve as Chair of the Department of Mathematics.

In his column, Tony Bloch has spoken of the passing of our colleagues, Juha Heinonen and Wilfred Kaplan. Wiflred contributed so much to the Department for such a long time that it is hard to imagine being without him.

The unexpected loss of Juha Heinonen this past year was a tremendous shock. He was an amazing man, both a renowned mathematician and a wonderful friend. He personified what it means to lead a balanced life. He will be greatly missed and long remembered.

Tony has described several of the more upbeat events of the year. Here, I want to look to the future and describe some of the things that will be happening over the course of the next three years.

We expect to be doing a significant amount of hiring. There has been a terrific, albeit unwelcome, testimonial to the quality of our faculty: many of them have gotten very good offers from other excellent mathematics departments. We have managed to retain a strong majority of those receiving such offers, but we have also had some losses. We anticipate being able to make a substantial number of faculty appointments at the tenure-track and tenured levels. Rob Lazarsfeld has taken over from Sasha Barvinok as Chair of the Personnel Committee. I want to thank both of them: Sasha for the work he has done over the previous two years, and Rob for his willingness to take over.

Dick Canary will be replacing me as Associate Chair for Term Faculty and Andreas Blass will be replacing Peter Hinman as As-

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Notes from the Chair

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students, several of whom have won the prizes which are awarded internally every year as detailed on pages 6, 7, and 9.

It goes without saying that we are very grateful to the valued alumni of our Department, whose support has helped to make our development and fund raising efforts very successful. Through the generosity of our alumni, faculty, emeritus faculty and Juha's many friends and colleagues, we were able to raise more than $50,000 for the Juha Heinonen Memorial Fund. The fund was established after Juha's passing and will provide graduate student support. This memorial is appropriate given Juha's dedication to young mathematicians and his extensive mentoring efforts. Our annual fund mailing to all alumni this year focused on funding for graduate student support. This was to take advantage of the President's Initiative to match at a 50% ratio contributions to funds designated to support graduate students. Other fund raising allowed us to continue our affiliation with the Inquiry Based Learning program, a program which funds exciting new innovations in teaching.

I would like to thank the faculty who served on the various Departmental committees while I was Chair. Dick Canary, Joe Conlon, John Erik Fornæss, Juha Heinonen, Peter Hinman, Mel Hochster, Curtis Huntington and Alejandro Uribe served as Associate Chairs. Sasha Barvinok and Mel Hochster chaired the Personnel Committee.

I would like to thank my Key Administrator, Doreen Fussman, and Laura Hornbeck who did so much work in this position while Doreen was away in Iraq. I would also like to thank my Executive Secretary, Sallie Kne, and all the wonderful faculty and staff members who were so helpful to me and to the Department. I am very grateful to each and every one of them. I would also like to express my thanks for the various messages of appreciation that I have received. It has been a pleasure

Finally, I would like to take this opportunity to wish Mel the very best in his new position. As I start my sabbatical I leave knowing that the department will be in his good hands.

Mel Hochster

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sociate Chair for Regular Faculty. I want to express my appreciation to all of them for their willingness, past and future, to take on these sizable jobs.

Our key administrator, Doreen Fussman, served in Iraq this past year. We are pleased that she has safely returned this fall. Laura Hornbeck has done a great job filling in, and all of our staff deserve high praise for stepping up during Doreen's absence.

We are due to have an External Review in March of 2009. A committee of distinguished mathematicians from other institutions will give their advice about various aspects of Department operations. This review was postponed from last year, partly because of the transition in the Chair and partly so that Doreen would be here to help get ready for it. I have asked the ADVANCE program to do a climate survey for the Department as part of the preparation for this review.

Regular faculty, postdocs, staff, and doctoral students will all have a chance to voice their opinions about how the Department operates and what we can do to improve.

During my term as Chair I would like to do a thorough evaluation of our teaching of Calculus, and, more generally, of our Undergraduate Program. I believe that we are doing an excellent job, but it has been a considerable time since we have attempted a substantial assessment of the program. The Department may seek external funding to study issues related to the teaching of Calculus. I want to mention that I have informally asked several graduate students and Postdoctoral Assistant Professors who have experience with the teaching of Calculus both at Michigan and elsewhere for their opinions of the system here. Uniformly, the answer that I got was that Michigan is better. This is encouraging to hear, but I feel that we need to do a more systematic analysis.

I am planning to make some changes in our website. I would like to give everyone ever associated with the Mathematics Department at any level, including current and former faculty, graduate and undergraduate students, staff, and visitors, as well as their families, the opportunity to have some space on our website to give contact information and, if they wish, describe briefly what they are doing now. This will enable people to keep in touch with friends who have been here at some point in their careers whom they might lose track of otherwise. Computer memory has become so inexpensive that I believe we can make such space available to anyone who is interested.

I would also like web pages for former faculty who have retired or passed away to be maintained for a very substantial period of time, perhaps fifty years.

Beyond that, I would like to think about what information we might make available on our web page, possibly with some limitations on access, that would increase its availability to those with a legitimate interest.

In the course of preparing for the job of chairing this Department, I learned a great deal from working with Tony Bloch. This was truly an education: I started with very little understanding of the magnitude of the tasks the Chair must assume.

In conclusion, I want to offer my deepest appreciation to Tony, both for all that he has done for the Department during his term as Chair, and for all of the help he gave me in getting ready to follow him.

Melvin Hochster, Chair
Jack E. McLaughlin Distinguished
University Professor of Mathematics

See more news of the University of Michigan Department of Mathematics on our website www.math.lsa.umich.edu

Gopal Prasad Named Collegiate Chair

Professor Gopal Prasd has been awarded a Collegiate Professorship. His Professorship will be named in honor of Raoul Bott, a member of the UM Mathematics faculty from 1951 to 1959. Bott was an admired pioneer in 20th century mathematics, particularly in the geometry and topology of Lie groups, and homogeneous spaces and representation theory.

Prasad received his Ph.D. from the University of Bombay. After visiting appointments at Yale and the Institute for Advanced Study, he joined the faculty at the Tata Institute of Fundamental Research in Mumbai. His 20 year career there culminated in a two year term as Dean of the School of Mathematics. He joined the UM faculty in 1992. Prasad has received significant recognition for his work. He is a member of the Indian National Science Academy and the Indian Academy of Sciences, and in 1989 received the Mathematical Sciences Prize from the Council of Scientific and Industrial Research in India. He was an invited speaker at the 1990 International Congress of Mathematicians. He received a Guggenheim Fellowship in 1998, and a Humboldt Senior Research Award in 2006.

Prasad is recognized as a leading expert in the theories of Lie groups and algebraic groups. The field has deep connections with problems and techniques in physics (classification of elementary particles); chemistry (crystallographic groups); and geometry, number theory, and numerous other branches of mathematics. The astounding breadth found in his past and current work is quite rare in the modern era of narrow specializations.

Prasad's most famous recent work solved a long-standing problem in algebraic geometry. In the beginning of the 20th century, the great Italian algebraic geometer Francesco Severi asked whether a smooth complex projective algebraic surface S whose underlying topology is "the same" as that of the complex projective plane P (the simplest such surface) must be that plane. It took more than fifty years before this question was answered in the affirmative by the Fields medalist S.-T. Yau. A refinement of this question is whether S is the same as P if the two

surfaces are merely assumed to have the same numerical topological invariants rather than the same underlying topology. It follows from a theorem of Yau that such an S that is different from P (a so-called "fake projective plane") must arise in a very special way, as the orbit space of a discrete subgroup Γ of the Lie group PU(2,1) acting on the two-dimensional complex ball. The existence of fake projective planes was established by the Fields medalist David Mumford in 1979. Since these fake planes are very intricate objects having the same numerical invariants as the simplest surface, they attracted a great deal of attention. However, Mumford's existence proof was quite indirect: it did not determine the group Γ, and it did not provide a concrete geometric description of the surface. After twenty-five years of unsuccessful efforts by many mathematicians, the challenge of giving a direct construction of these surfaces had become one of the major open problems in algebraic geometry.

In a breakthrough paper that appeared recently in *Inventiones Mathematicae*, one of the most distinguished journals in pure mathematics, Prasad and S. K. Yeung solved this problem by giving the first effective construction of a fake projective plane. In fact, they did something even more remarkable: they obtained an almost complete classification of the groups Γ that can occur. Their work involved an intricate and subtle blend of geometry, number theory, and the structure theory of algebraic groups. These results have attracted a great deal of attention from the mathematical community.

Prasad has also recently completed pathbreaking research in a very different direction, concerning whether a Riemannian manifold (generalizations of the kinds of geometric spaces that arise in Einstein's theory of general relativity) is determined by spectral data such as the spectrum of its Laplacian, or its length spectrum. Using deep results from number theory and algebraic groups, Prasad and Andrei Rapinchuk completely analyzed this question for arithmetic locally symmetric spaces of non-positive curvature. These classical objects form a large and extremely important class of Riemannian manifolds, and their work represents a quantum leap in our understanding of spectral theory.

In the mid-1990s, Prasad and former UM colleague Allen Moy wrote two papers on the representation theory of p-adic groups. These papers established a new invariant for representations of p-adic groups, affirmatively answered a very old and important conjecture relating the representation theory of p-adic groups with that of finite Lie groups, and re-introduced Bruhat-Tits theory to representation theory. Perhaps more importantly, the methods introduced in these papers have played a central role in the solution of at least two outstanding problems in the field, leading to explosive progress in several directions.

In a recent joint work with a former UM colleage Brian Conrad, and Ofer Gabber of IHES, France, Prasad has given a classification of nonabelian pseudo-reductive algebraic groups over all fields of odd characteristics. This work settles an outstanding problem in the area and has several important arithmetic applications.

His earlier results on strong rigidity, strong approximation, the congruence

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Faculty Kudos

DeBacker

Professor **Hyman Bass** has been named the Samuel Eilenberg Distinguished University Professor of Mathematics and Mathematics Education, LSA and School of Education. This competitive and prestigious award is the highest honor that the University bestows on senior faculty "to recognize exceptional scholarly and/or creative achievement, national and international reputation, and superior teaching skills." Samuel Eilenberg was on the faculty of the Mathematics Department during the 1940s.

Associate Professor **Stephen DeBacker** has received an Excellence in Concentration Advising Award from the College of Literature, Science, and the Arts.

Assistant Professor **Selim Esedoglu** was promoted to Associate Professor of Mathematics. He also received a 2008 NSF CAREER award for his project "*Analysis and modeling for image processing problems*." The CAREER awards provide early career development for faculty with outstanding potential.

Gilbert

Assistant Professor **Daniel Forge**r received a Young Investigator Research award from the Air Force Office of Scientific Research. Forger will study physiology modeling of circadian timekeeping. The Young Investigator awards support recent Ph.D. recipients (<5 years) who show exceptional ability and promise for conducting basic research. The program aims to foster creative basic research in science and engineering, enhance early career development of outstanding young investigators, and increase opportunities for the young investigators to recognize the Air Force mission and the related challenges in science and engineering.

Associate Professor **Anna Gilbert** is the recipient of the 2008 National Academy of Sciences Award for Initiatives in Research. The award recognizes innovative young scientists and encourages research likely to lead to new capabilities for human benefit. She is being recognized for her work with innovative algorithms using wavelets and sampling techniques and their impact on data analysis and sparse approximation.

Krasny

Professor **Trachette Jackson** has been named one of the Emerging Scholars of the Year by *Diverse Issues In Higher Education* magazine. She was profiled in one of the magazine's 2008 issues. The scholars are nationally recognized for their research, educational background, publishing record, teaching record, competitiveness and uniqueness of field of study, and recommendations from other faculty members, department chairs and students. Diverse: Issues In Higher Education is America's preeminent newsmagazine that covers news and information about the ever-changing world of higher education. Jackson was promoted to Professor of Mathematics this year.

Professor **Robert Krasny** has been elected a Fellow of the American Physical Society in the Division of Fluid Dynamics. Election to fellowship in the APS is limited to no more than one half of one percent of its membership each year.

Megginson

Professor **Jeffrey Lagarias** is one of the recipients of the Lester R. Ford Award from the Mathematical Association of America, awarded at the August Summer MathFest in San Jose, CA. Established in 1964, the award, which includes a citation and cash prize, is presented for articles of expository excellence published in the American Mathematical Monthly. Lagarias received the recognition for his article "Wild and Wooley Numbers," vol. 113, No. 2, 2006.

Professor and LSA Associate Dean **Robert Megginson** has been named an Arthur F. Thurnau Professor. The Thurnau Professorships recognize outstanding contributions to undergraduate education. Megginson is the winner of numerous campus and national awards for excellence in mathematics education. He is credited with reforming introductory math courses to emphasize real-world problem solving and cooperative learning. He also re-designed the Mathematics Learning Center to focus on mastery of basic skills, leaving classroom time for learning the higher order thinking that is at the heart of mathematics education.

Associate Professor **Kristen Moore** has been awarded the Class of 1923 Memorial Teaching Award from the College of Literature, Science and the Arts. The award recognizes her outstanding teaching abilities and innovative classroom techniques.

Mircea Mustata was promoted to Professor of Mathematics.

Martin Strauss was promoted to Associate Professor of Mathematics.

Moore

New Faculty Members

Assistant Professor Juan Souto

Souto joined the Department in winter, 2008. He received his Ph.D. from the Rheinische Friedrich-Wilhelms-Universität in Bonn, Germany. From 2001 to 2004 he held the position of Wissenschaftlicher Assistent at that institution. In 2005 he held a Research position at the Université Paul Sabatier in Toulouse, France. He then joined the faculty at the University of Chicago for two years.

Souto's field of research is in geometry/topology, specifically in hyperbolic geometry and Kleinian groups, with broader interest in 3-dimensional topology and rigidity theory. His publications include a paper that solved a twenty year old conjecture and contributed to the proof of the Bers-Sullivan-Thurston Density Conjecture, and another which was influential in the solution of Marden's Tameness Conjecture.

Professor Roman Vershynin

Vershynin joined the Department in fall 2008. He received his Ph.D. from the University of Missouri-Columbia. After one year as a Research Postdoctoral Fellow at the Weizmann Institute in Israel and two years as a PIMS postdoctoral Fellow at the Pacific Institute for Mathematical Sciences and the University of Alberta, he came to the University of California, Davis as an Assistant Professor. He received a Sloan Research Fellowship in 2005, and was promoted to Associate Professor in 2006.

Vershynin's research interest is geometric functional analysis, exploring connections among functional analysis, convex geometry and probability theory. He has established himself as a leader in this area, and he has the ability to apply his expertise to a wide variety of problems, many of them drawn from applied mathematics. Several of Vershynin's papers contain solutions to long outstanding conjectures, and have been published in top journals.

Gopal Prasad

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subgroup problem, determination of central extensions and the metaplectic kernel, and the computation of the covolume of arithmetic subgroups are well-known and widely used.

The enormous diversity of Prasad's work is evidenced by numerous important papers of his on algebraic and arithmetic groups, algebraic geometry, Bruhat-Tits theory, differential geometry, ergodic theory, number theory, and representation theory.

In the Department, Prasad is recognized as a devoted and effective teacher at all levels. He has directed four Ph.D. theses here, and developed a course on the theory of Lie groups. His colleagues in the Department have recognized him as an invaluable source of advice and insight on a wide panorama of mathematical subjects, always willing to share ideas and help with problems.

Since 1998, Prasad has been managing editor of the *Michigan Mathematical Journal*. Through his leadership, he has expanded the breadth of the editorial board to include highly regarded mathematicians from around the world. The Journal has risen in stature and importance in the mathematical community. Prasad is also an editor for the *Asian Journal of Mathematics* and an associate editor of the *Annals of Mathematics*, considered by many to be the most prestigious mathematics journal. He has served on the Department's Executive Committee several times.

Math Problem

A jar contains 600 jelly beans: 100 red, 200 green, and 300 blue. These are drawn randomly from the jar, one at a time, without replacement. What is the probability that the first color to be exhausted is red?

Answer elsewhere in the newsletter

2007-08 Graduate Program Fellowships & Awards

A.V. Flint Memorial Scholarship

Brian Jennings

Alice Webber Glover Math Fellowships

Clara Blakelock
Sohhyun Chung
Ajinkya More
Lei Wang

Allen L. Shields Memorial Scholarship

Katarina Bodova

Alta B. West Math Scholarship

Julian Rosen

Arthur Herbert Copeland, Sr. Memorial Scholars

Henry Boateng
Jose Gonzalez
Ross Kravitz
Nina White

Wirt and Mary Cornwell Prize

Susan Sierra

Cameron & John Courtney Scholarship

Fidel Jimenez
Benjamin Weiss

CONACYT Fellowship

Gerardo Hernandez

Fulbright Scholarship

Richard Vasques

G. Cleaves Byers Endowment

Jennifer Beichman
Harlan Kadish
Zian Yin

Lucent Fellowship

Ellen Eischen

Luther Claborn Mathematics Fellow

Russell Golman

Mathematics Department Graduate Fellowship

Samuel Altschul
Timothy Ferguson
Aurel Fulger
William Gignac
Geri Izbicki
Brian Jennings
Nicholas Rupprecht
Austin Shapiro
Paul Shearer
Sourya Shrestha

National Physical Science Consortium Fellowship

Marie Snipes

National Defense Science and Engineering Graduate Fellowship

Brian Wyman

National Science Foundation Fellows

Ryan Kinser
Zachary Scherr

Natural Science & Engineering Research Council of Canada Scholarship

Luis Serrano

Carroll V. Newsom Scholarships

Oscar Fernandez
Steven Flores
Ricardo Portilla
Crystal Zeager

E.S. & A.C. Everett Memorial Scholarship

Catherine Dupuis

Edwin Wilkinson Miller Scholarship

Eugene Eisenstein

Rackham International Fellowship

Florian Block

Rackham One-Term Dissertation Fellows

Tigran Ananyan
Henry Boateng
Craig Spencer

Rackham Predoctoral Fellow

Susan Sierra

Rackham Science Award (RSA)

Jonathan Bober
Aubrey da Cunha
Daniel Hernandez
Ricardo Portilla
Chelsea Walton

Gabrielle & Sophie Rainish Fellowship

Katarina Bodova

Regents' Fellowship

Johanna Mangahas

Research Training Grant (RTG) Algebra

David Anderson
Elizabeth Chen
Kyle Hofmann
Brian Jurgelewicz
Yogesh More
Kelli Talaska
Kevin Tucker

Research Training Grant (RTG) Geometry

David Constantine
Jasun Gong
Christopher Hammond
Paul Johnson
Aaron Magid
Johanna Mangahas
Felipe Ramirez
Diane Vavrichek
Marshall Williams

Royal Thai Government Scholarship

Panu Sam-ang

Graduate Departmental Scholarship

Taeyong Ahn
Peter Bosler
Jiarui Fei
Huaiying Gu
Shawn Henry
Bich Hoai
Xueying Hu
Geri Izbicki
Stephanie Jakus
Johnson Jia

Shin-Yao Jow
Hyosang Kang
Wansu Kim
Marc Krawitz
Cagatay Kutluhan
Sara Lapan
Robin Lassonde
Michelle Lee
Ray Maleh
Jeffrey Meyer
Andrey Mishchenko
Alexander Mueller
Tomoki Ohsawa
Kyle Ormsby
Kristofer-Roy Reyes
Joseph Roberts
Darragh Rooney
Jordan Sahattchieve
Ashley Selegue
Lindsey Selegue
Alan Stapledon
Nathan Totz
Michael Von Korff
Ting Wang
Jordan Watkins
Jared Whitehead
Szymon Wojczyszyn
Hao Xing
Qin Qing Xue
Hsu-Wen Young

Sumner Myers Award

Bryden Cais, above, received the Sumner Myers Award for best Ph.D. thesis in 2007. Bryden is now a CRM-ISM Postdoctoral Fellow in the Department of Mathematics at McGill University in Canada.

Recent Ph.D. Recipients

Oscar Felgueiras completed his dissertation "*The Ample Cone for a Morphism*" under the direction of Robert Lazarsfeld. He will be an Assistant Professor at Universidade do Porto.

Sara Gentry completed her dissertation "*Mathematical Modeling of Mutation Acquisition in Hierarchical Tissues: quantification of the Cancer Stem Cell Hypothesis*" under the direction of Trachette Jackson. She will be a Lecturer at the University of Michigan.

Jose Gomez-Guerra completed his dissertation "*Models of Twisted K-Theory*" under the direction of Igor Kriz. He will be a Postdoctoral Research Fellow at the University of British Columbia.

Jasun Gong completed the dissertation "*Derivations on Metric Measure Spaces*" under the direction of Juha Heinonen and Mario Bonk. He will be Postdoctoral Associate at the University of Pittsburgh.

Mark Iwen completed his dissertation "*Algorithmic Compressed Sensing with Applications*" under the direction of Martin Strauss. He will be a Postdoctoral Member at the Institute for Mathematics and its Applications.

Harsh Jain completed the dissertation "*Quantitative Modeling of Molecular Pathways Associated with Intratumoral Angiogensis*" under the direction of Trachette Jackson. Harsh will be a Research Fellow at the Frankfurt Institute at Goethe University, Germany.

Jason Kutch completed his dissertation "*Signal in Human Motor Unsteadiness: Detecting the Action and Activity of Muscles*" under the direction of Tony Bloch. He will be a Postdoctoral Research Associate at the University of Southern California

KyungYong Lee completed the dissertation "*On Realization of Line Arrangements as Multiplier Ideals*" under the direction of Robert Lazarsfeld. Kyung will be a Research Assistant Professor at Purdue University.

John Mackay completed his dissertation "*Conformal Dimension and the Quasisymmetric Geometry of Metric Spaces*" under the direction of Bruce Kleiner. He will be a Doob Research Assistant Professor at the University of Illinois.

Jared Maruskin completed his dissertation "*On the Dynamical Propagation of Subvolumes and on the Geometry and Variational Principles of Nonholonomic Systems*" under the direction of Tony Bloch. He will be an Assistant Professor at San Jose State University.

Yogesh More completed the dissertation "*Arc Valuations on Smooth Varieties*" under the direction of Karen Smith. Yogesh will be a Postdoctoral Research Fellow at the University of Missouri.

Hannah Robbins completed her dissertation "*Finiteness of Associated Primes of Local Cohomology Modules*" under the direction of Mel Hochster. She will be Postdoctoral Fellow at Wake Forest University.

Susan Sierra completed her dissertation "*The Geometry of Birationally Commutative Graded Domains*" under the direction of Toby Stafford. She will be a NSF Postdoctoral Fellow at the University of Washington.

Craig Spencer completed his dissertation "*Analytic Methods for Diophantine Problems*" under the direction of Trevor Wooley. He will be a member at the Institute for Advance Study.

Joe Stubbs completed his dissertation "*Potent Elements and Tight Closure in Artinian Modules*" under the direction of Mel Hochster. He will be an Information Analyst at the University of Texas.

Giancarlo Urzua completed his dissertation "*Arrangements of Curves and Algebraic Surfaces*" under the direction of Igor Dolgachev. He will be a Postdoctoral Research Fellow at the University of Massachusetts.

Diane Vavrichek completed her dissertation "*Accessibility and JSJ Decompositions of Groups*" under the direction of Peter Scott. She will be a Visiting Assistant Professor at SUNY Binghamton.

Bo Yang completed the dissertation "*Application of Perturbation Methods to the Development of a Unified Framework for Pricing Credit and Equity Derivatives*" under the direction of Erhan Bayraktar.

Congratulations to our 2007-08 Mathematics Bachelor of Arts/Science Degree Recipients

April 2008

Some recipients of the Outstanding Achievement in Mathematics Award: l-r, Bernard Yiu, Peter Troyan, Zhe Tan, Dominick Bartelme, Thomas Fai, Elizabeth Otto, Professor Curtis Huntington.

Sohair Abdelrahman
Jonathan Acker
SeHyoun Ahn
Ryan Allen
Lisa Aronovsky
Brian Baisa
Haikal Fikri Abu Bakar
Dana Barhoumeh
Douglas Barritt
Dominick Bartelme
Andrew Birch
Andrew Bleeker
Michael Bliss
Michael Bommarito
Caroline Bowden
Nikolai Brendler
Andrew Brod
Jonathan Buck
Lisa Carpenter
Hasan Cheema
Victor Chen
Daniel Cheong
Andrew Chew
Kai Kiat Chooi
Eugene Chung
Sung Hun Chung
Allison Cole
Britain Cox
Laura Distelrath
Heather Dougherty
Thomas Fai
Edward Fletcher
Jessica Fornari
Eric Fu
Brandon Gipper
Nathan Green
Garrison Grove
Jiong Gu
Brian Haber
Rachel Harrison
Thomas Hartsig
Gregory Haskins
Yuen King Ho
Todd Jarema
Xiaoyin Jia
Zhangli Jiang
Paul Johnson
Timothy Kang
Seulgi Kim
Tai Il Kim
Cory Knill
Manpreet Kochhar
Rachel Kraft
Matthew Kuhlman
Lisa Kurtz
Matthew Laeder
Voon Seng Lai
Yin Jing Lai
Ka Yan Lam
Brett Larsson
Melissa Mei Yen Lee
Nora Lewandowski
Kwan Ho Li
Yiqiao Li
Li Li Lim
San Lo
Zachary Maddock
Vrinda Mahishi
Caitlin Marlatt
Christopher Marshall
Marshall Mawson
Betty McColor
Timothy McQuade
Mohamed Mukhriz Mohamed Hashim
Corina Mommaerts
Shi Ting Ng
Philip Ngan
Jin Ye Ngu
Baonguyen Nguyen
Hui Fen Ooi
Elizabeth Otto
Keng Yang Phua
Anthony Pinter
Andrew Preston
Lindsay Pushies
Kah Wai Putt
Asha Radhamohan
David Randazzo
Matthew Rosenberg
Christian Santos
Andrew Sardone
Ren Jie Saw
Nicolas Scheiblauer
Rahul Shah
You Jin Shin
Laurel Shipley
Shanna Singer
Patrick Smalley-Wall
Hoi Ying So
Guido Sofo
Samuel Soichet
Smrithi Srinivasan
David Swenson
Zhe Tan
Ya-chin Tang
Brian Timm
Ernest Travis
Peter Troyan
Richard Turner
Taichi Udo
Arthur Urban
Derek Van Farowe
Rajeev Vijay
Paige Warmker
Joshua Welling
William Wilcox
Kevin Wilson
Jonathan Wiseman
Poh Yi Wong
Stephen Wu
Wai Ling Wu
Chia Chye Yee
David Yee
Ying Ki Yim
Bernard Yiu
Christopher Young

2008 Undergraduate Award Recipients

The Department's team for the William Lowell Putnam Mathematics Competition placed 14th out of 413 teams in the event. The members of this year's team were **Daniel Echlin, Timothy Heath,** and **Jeffrey Madsen.** The individual competition included 3640 students from across North America. **Timothy Heath** placed the highest of UM students at 126. **SyHoun Ahn**, **Daniel Hermes,** and **Jeffrey Madsen** also finished in the top 200.

The winner of the 25th Annual University of Michigan Undergraduate Mathematics Competition was **Jeffrey Madsen**, achieving his third win. **Zili Huang** placed second.

The following student received the **Mathematics Alumni/Alumnae Scholarship** for the 2007-08 academic year:

Mendel Feygelson

The following students received **Evelyn O. Bychinsky Awards,** which recognize underclass students who show exceptional promise in mathematics:

Daniel Echlin II
Daniel Hermes
Wade Hindes
Zili Huang
Andrew Kiluk
Steven Moses
Alfredo Wetzel

The following students received **Margaret S. Huntington Awards in Actuarial Outreach:**

Shulamite Chiu
James Cooper
Samuel D. Faught
Ellyn Gendler
Jin Sheng Ooi
Vinay Patel
Syed Nabil Shahabudin
Spencer Smith
Rosaline Tio
Chenli Zhu

Eric Fu received the **Leon P. Zukowski Prize** for outstanding service in the Mathematics Learning Center (formerly known as the MathLab).

The **William LeVeque Award in Number Theory** was presented to **Jeffrey Madsen**. The award recognizes a student who is at most a junior and excels in the study of number theory.

The Sumner Myers Award in Analysis was presented to **SeHyoun Ahn**.

Outstanding Achievement in Mathematics Awards went to the following seniors:

Dominick Bartelme
Britain Cox
Thomas Fai
Elizabeth Otto
Anthony Pinter
Zhe Tan
Peter Troyan
Paige Warmker
Bernard Yiu

The **Otto Richter Memorial Prize in Actuarial Science** was presented to **Paul Johnson**.

John Shepard, Elizabeth Lee & Professor Curtis Huntington.

The **CIGNA Award in Actuarial Science** was presented to **Elizabeth Lee** and **John Shepard**.

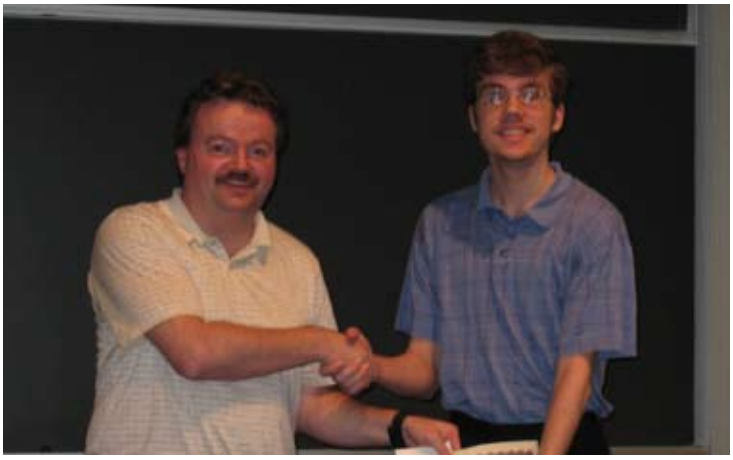
The **Irving Wolfson Award in Actuarial Science** was presented to **Christopher Kurdelski**.

The **Lois Zook Levy Memorial Award** was presented to **Rachel Kraft**. The award recognizes an outstanding Mathematics student who plans to pursue a career in K-12 Mathematics education.

The following students were named **Michigan Mathematics Merit Scholars**:

Zachary Maddock
Timothy McQuade
Richard William Turner

Kevin Wilson was named the **Outstanding Graduating Senior.**



Above: Professor Hendrikus Derksen with Jeffrey Madsen.
Right: Zili Huang with Professor Stephen DeBacker.

Actuarial Program News

Those of you who graduated more than a few years ago may not be familiar with the frequent, and significant, changes that have been occurring in the educational syllabus of both the Casualty Actuarial Society (CAS) and the Society of Actuaries (SoA) in recent years. These changes have a direct impact on the students, and on the curriculum these students take, while at the University.

The Michigan Actuarial Program has never been designed to 'teach to the professional syllabus.' Rather, it has emphasized the learning of basic principles along with developing a set of problem solving skills. Nevertheless, we have made a number of changes in the curriculum to reflect the new environment.

The most significant changes have occurred in the field of financial economics. Some changes are simple—the name of the Theory of Interest examination is now 'Financial Mathematics.' Other changes are more extensive—Examination MFE (called Examination 3F by the CAS) covers the topic of mathematical economics and was designed also to be used to test candidates for the new CERA (Chartered Enterprise Risk Analyst) designation. Existing courses have been changed to reflect new content and several new courses have been added.

The actuarial societies have also recently re-characterized some of the old examination subjects as being part of a preliminary education component that is no longer tested but is still required. A process, called 'Validation by Educational Experience' (VEE), has been established for the three subjects involved —Economics, Corporate Finance and Applied Statistical Methods. Students who take pre-approved college courses and successfully complete these courses with a grade of B- or higher are assumed to have gained the required knowledge in these three subjects.

Most of our current students seek to maximize their Michigan experience by also fulfilling all of their VEE requirements while undergraduates. This has had a direct impact on the enrollments in some other UM Departments and provided opportunities for the faculty to get involved in a number of inter-disciplinary initiatives.

At the same time, interest in courses in financial mathematics from students with other declared concentrations has shown significant growth throughout the University. Virtually every course that we offer in this field fills up with students eager to enter this new area. Our major problem here is finding enough instructors to be able to run classes with reasonable enrollment numbers, rather than merely offering a large lecture course.

The student-run club, the Student Actuaries @ Michigan (or SAM) maintains an active schedule of academic, sporting and social events. With more 100 members, this group is rapidly becoming one of the more active academically-focused groups on campus. Students pay annual dues to be a member of SAM and the group is run by an Executive Committee of 9 students.

Students who are members of SAM and have completed courses related to the professional examinations (for example, Mathematics 425—Probability for the first examination—Exam P/1) become eligible for a subsidization of their examination fees. These fees, particularly for college students are not trivial. The first two examinations cost $175 each; the next ones are in the $360-400 range.

For the Spring, 2008 examination sessions, the Department paid more than $16,000 in subsidized examination fees. With increased enrollments and increased examination fees, the subsidization program has become a significant recurring expense.

Members of SAM visited several area high schools as part of our continuing outreach to let local students and teachers become more aware of the actuarial field and the opportunities that are available. SAM also donated $1,000 of funds at the end of the academic year to sponsor one of the annual Margaret S. Huntington Awards in Actuarial Outreach.

Our April 2008 Cecil J. Nesbitt Commencement Lecturer this year was Karen Olsen MacDonald (BA 1975, MA 1976), Vice President and Actuary at WellPoint (Woodland Hills, CA). Her message of lessons learned from her experiences after graduation from Michigan in both large companies and her current assignment was well-received by an enthusiastic audience of this year's graduates (and their families). This was the sixth event in this series. This is a fun event for the faculty to plan and is the highlight of the actuarial academic year.

Finally, we are actively planning a new actuarial alumni/ae directory. This will be a time-consuming activity and will involve a number of students. During the process, you may receive a call from one of the students asking to verify information for the directory. If you do get such a call, I hope that you will take the opportunity to talk with the student about what is happening in Ann Arbor and get a feel for the dynamics of the current environment. Also, please let them know what is happening in your life so that we can report that in future issues on ContinuUM.

The faculty and students look forward to hearing from you with any comments, questions or suggestions you might have. And, if your travels bring you though Ann Arbor, please let us know so that we can host a visit with us in our East Hall home.

Curtis E. Huntington (BA 1964, MAS 1965), FSA, FCA, MAAA, APM
Professor of Mathematics
Director, Financial & Actuarial Mathematics Programs
Director MPET Program

Honors Math Students from the '50s, '60s, and 70s

If you took the 90s sequence of Honors Math during that era, we'd like to hear from you. If you are interested in getting together for a reunion to discuss the trials, tribulations and triumphs of honors math students, please contact the math department at math.mich@umich.edu, or Don Lewis at djlewis@umich.edu. We'd love to hear from you!

Alumni News

Tom Wilkerson (BS 1953, PhD Physics 1962) received the 2007 Utah Governor's Medal for Science and Technology. Wilkerson is a professor in Utah State University's Physics Department and its Center for Atmospheric and Space Sciences, and is a senior scientist with Utah's Space Dynamics Laboratory. He taught Physics and Mathematics at the University of Maryland for 24 years prior to joining Utah State. Wilkerson is an internationally recognized expert in the use of lasers to perform remote sensing of the atmosphere—known as light detection and ranging or LIDAR. He has also been responsible for numerous advances in the fields of high temperature shock waves, the "solar wind" plasma, and the optical spectroscopy of ionized gases. The State of Utah awards the Governor's Medal to recognize individuals who have provided distinguished service to Utah in the fields of science and technology. It is the highest honor awarded by Utah for scientific and technological achievements.

Steven D. Bennett (BA 1965, MBA Kent State 1977) is a high school math teacher with Cleveland Metropolitan Schools and the SuccessTech Academy.

Herb Hethcote (PhD 1968) retired from the University of Iowa after 37 years as a Professor of Mathematics. He was the Director of the interdisciplinary Ph.D. program in Applied Mathematical and Computational Sciences. His major research focus was mathematical modeling of the spread and control of infectious diseases. He coauthored two books and had over 80 research papers. He and his wife now live on Bainbridge Island, Washington, near their two married sons.

Barry Garelick (BA 1971), is an Environmental Protection Specialist with the U.S. Environmental Protection Agency. He is involved in the issue of K-12 math education, and has written several articles on the subject.

James C.R. Burns (BS 1971, MS Radiological Physics, University of Colorado, 1973) is the Chief Medical Physicist in Oncology with Promedica Health Systems in Sylvania, OH.

J. Brian Conrey (PhD 1980) has received the 2008 Conant Prize from the American Mathematical Society. The Conant Prize recognizes an outstanding expository paper published in either the Notices of the AMS of the Bulletin of the AMS in the previous five years. Conrey's article "The Riemann Hypothesis" was published in the Notices of AMS, March 2003, pp. 341-353. The article outlines the mathematical context that justifies the importance of the Riemann Hypothesis, key moments in the problem's 140 year history, known partial results and blind alleys, various threads of numerical and theoretical evidence, and suggestive connections with disparate branches of mathematics and theoretical physics. Conrey is currently a Professor of Mathematics at the University of Bristol. He is the founding executive director of the American Institute of Mathematics, and formerly was a member of the mathematics facutly at Oklahoma State University.

David W. Centner (BS 1986, JD Indiana University) is a founding member of the West Michigan office of Clark Hill, PLC. Clark Hill has approximately 175 lawyers in five offices located throughout the state of Michigan and in Chicago. He continues to practice litigation, with a specific emphasis on complex commercial litigation, creditor's rights and bankruptcy, and intellectual property litigation. David has been married for 18 years, has four children, and is active in a number of professional and nonprofit organization.

Michael Frank (BS 1987) is President and Actuary at Aquarius Capital in New York. In 2007, he was elected to the Society of Actuaries Reinsurance Section Council, and he was appointed Chairperson of the Continuing Education Committee of the Actuarial Society of Greater New York.

Martin Erickson (PhD 1987), Professor of Mathematics at Truman State University, and **Anthony Vazzana** (PhD 1998), Associate Professor of Mathematics at Truman State University, have recently written the textbook "Introduction to Number Theory" (Chapman & Hall/CRC Press, 2008).

Patrick Bidigare (PhD 1997) is the Technology Director for BBN Technologies in Virginia.

Sarah-Marie Belcastro (PhD 1997) and **Carolyn Yackel** (PhD 1998) are editors of the book "Making Mathematics with Needlework" (A.K. Peters. Ltd., 2007). The book successfully connects the worlds of mathematics and fiber arts. Each chapter covers a different mathematical paper and corresponding needlework project and includes mathematical explanations, needlework instructions, educational materials, and specific projects to demonstrate the principles discussed. The colorful collection presents examples of current research and issues still to be investigated, using topology, graph theory, number theory and algebra, very basic combinatorics, observations of symmetry, and brute force. Belcastro co-directs the Hampshire College Summer Studies in Mathematics and is currently a Visiting Assistant Professor of Mathematics at Smith College. Yackel teaches Mathematics at Mercer University, where she has developed a general-education course in mathematics through fiber arts and regularly teaches for the Interdisciplinary Studies program.

In Memoriam

Professor Juha Heinonen

Professor of Mathematics Juha Heinonen passed away on October 30, 2007, after a courageous battle with kidney cancer. Born July 23, 1960 in the small town of Toivakka in central Finland, Juha was raised in the village's old-age home where his mother served as the sole staff member. His father Vilho was a lumberjack and well-respected socialist politician in the tiny town. After graduating high school, Juha served one year as an officer in the Finnish army, and then enrolled as a student of mathematics at the University of Jyväskylä. His 1987 Ph.D. thesis, directed by Olli Martio, was in non-linear potential theory.

Juha first came to the University of Michigan for a semester as a visiting graduate student in 1985. His first appointment in the Department of Mathematics began in 1988, when he returned as a three year post-doctoral assistant professor. In 1992 he accepted a tenure track assistant professorship, and in 2000 he was promoted to professor. He served as Associate Chair for Graduate Studies in the Department of Mathematics from 2004 to 2007.

Considered a scholar possessing high professional standards, Juha was a leading figure in geometric function theory, his main research area. His two books "Nonlinear Potential Theory of Degenerate Elliptic Equations" (co-authored with T. Kilpeläinen and O. Martio) and "Analysis on Metric Spaces" have become standard references in their fields. He co-authored more than 60 research papers, many of which contributed to the creation of a new branch of mathematics, now called analysis on metric spaces. Juha was a generous and enthusiastic collaborator who was proud of the fact that nearly all of his research publications were joint works. His collaborators admired him for his erudition, his deep mathematical insights, and his never-ending scientific curiosity.

Juha's expertise was recognized with many awards and fellowships, including a Sloan Fellowship, numerous NSF grants, several visiting appointments, and an Excellence in Research Award from the University of Michigan. For seven years he was an editor of the Proceedings of the American Mathematical Society. In 2002, he was invited to give a talk at the International Congress of Mathematicians in Beijing. Juha became

a member of the Finnish Academy of Science and Letters in 2004.

A dedicated thesis advisor, Juha directed eight doctoral students. Many students, junior faculty, and young researchers greatly benefited from his patient mentorship and wise tutelage. Juha was very grateful for the excellent mentoring he himself received as a young mathematician, and was happy to repay in kind. In addition to his advisor, he especially acknowledged U-M Professor Emeritus Fred Gehring whom he met in 1985, and Jose Fernandez, to whom Fred introduced him later that academic year at the Mathematical Sciences Research Institute in Berkeley. Later he was deeply influenced by Dennis Sullivan who directed his attention to analysis in more abstract settings.

When Juha originally came to the United States, his intention was to stay for only a short period. His plans changed when he met his future wife, Karen Smith, a first-year graduate student of mathematics, who also arrived in Ann Arbor in the fall of 1988. They were married in 1991. Juha put his own career on hold to follow his wife to Boston when she obtained a post-doctoral position at MIT. The couple came back to Ann Arbor as tenured professors in 1996, settling into a satisfying marriage and productive careers. They welcomed their daughter Sanelma in 1998, and their boy-girl twins, Tapio and Helena, in 2003.

A gifted athlete, Juha was the 1976 Finnish national champion in his class for 5 km cross-country skiing. Although he gave up professional sports to pursue a career in mathematics in the early 1980s, Juha's love of competitive sports never waned. He participated in many running, cross-country skiing and orienteering events around the country. In his class he won both the U.S. and the North American gold medal in orienteering in 2000.

Juha was a vibrant, balanced, satisfied person who enjoyed many things in life besides mathematics and sports. He spent his free time studying foreign languages, or reading history, biographies, and political commentary. He loved the outdoors, particularly Michigan autumns and Finnish winters. A devoted husband and father, Juha enjoyed the company of his children and was often spotted on errands around town with a child on the bus, on his bike-seat, or in his arms. Each time he spoke of his family, the pride was evident through the twinkle in his eye and his broad grin.

His Finnish origins remained deeply important to him throughout his life. Juha maintained close contacts with his Finnish friends and colleagues, and traveled to Finland at least once a year. He taught his children and his wife to speak Finnish and to share his love of his native land.

Juha was widely loved for his positive attitude, sparkling sense of humor, and genuine kindness towards others, traits that he maintained throughout the difficult trials of his illness. He is deeply mourned by his family, friends and colleagues. Besides his wife and children, Juha is survived by his mother Liisa Heinonen and his sister Maritta Nukarinen. A memorial service held in December was attended by nearly 400 people. The Department of Mathematics has established the Juha Heinonen Memorial Graduate Student Fellowship. Information is available at http://www.math.lsa.umich.edu/events/juhaMem.html

Professor Wilfred Kaplan

Wilfred Kaplan, Professor Emeritus of Mathematics at the University of Michigan, died on December 26, 2007 after a short illness, at the age of 92. He was born in Boston, Massachusetts on November 28, 1915, the son of Jacob and Anne (Levenson) Kaplan. After graduation from Boston Latin School, he entered Harvard University, where he completed his A.B. degree in mathematics summa cum laude. With a traveling fellowship he then spent the year 1936-37 in Europe, where his fluency in German and French helped him to meet and confer with many leading mathematicians. He met Heinz Hopf in Zürich; Levi-Civita in Rome; Pontryagin, Kolmogorov, and P.S. Alexandrov in Moscow; Kuratowski and Borsuk in Warsaw; Hadamard, Borel, Denjoy, and Elie Cartan in Paris; Kerékjártó and Fejér in Hungary. While attending lectures at the E.T.H. in Zürich, he met another mathematics student, Ida ("Heidi") Roettinger, who would become his wife of 66 years. In addition to mathematics, they shared a passionate interest in music and literature. They were married in 1938 and lived for a year in Houston while Wilfred taught at Rice Institute. Wilfred obtained his Ph.D. from Harvard in 1939, as a student of Hassler Whitney, then taught for a year at William and Mary before joining the faculty at the University of Michigan in 1940, where he served until his retirement in 1986.

During the war years 1944 to 1945, the Kaplans were away from Ann Arbor while Wilfred did military research in a group of mathematicians at Brown University. After the war they made frequent trips to Switzerland for extended stays with Heidi's family. They spent the year 1949-50 in Zürich while Wilfred held a Guggenheim Fellowship.

Wilfred Kaplan had extraordinary mathematical talent. He published about 30 research papers on topological behavior of solutions of differential equations, complex function theory, and applied mathematics; and he supervised 8 Ph.D. students. He was an outstanding teacher and the author of a series of important and influential textbooks. His text Advanced Calculus, first published in 1952, has been translated into many languages and continues to be used in many universities worldwide. Among his other texts are Ordinary Differential Equations (1958), Operational Methods for Systems (1962), Calculus and Linear Algebra (with D. J. Lewis, 1968), Advanced Mathematics for Engineers (1981), and Maxima and Minima with Applications: Practical Optimization and Duality (1999). In 2007, Calculus and Linear Algebra was reprinted by the UM Library to be used again in UM Mathematics courses. "First and foremost, Wilfred Kaplan was a teacher," says colleague Don Lewis. "He enjoyed conveying the beauty and usefulness of mathematics, and his students responded enthusiastically. He was a superb expositor, and his ability to elegantly convey mathematical ideas explains the enormous impact of his textbooks. When we were writing our joint texts, he never came to a meeting without a new idea to be incorporated."

Throughout most of his professional career, Wilfred was active in the affairs of the American Association of University Professors (AAUP), a national organization dedicated to defending faculty rights, especially academic freedom and tenure. He served as president of the UM Chapter, president of the Michigan Conference, and member of the national AAUP Council. He was helpful in bringing collective bargaining to several universities in Michigan, with the AAUP as agent. "Wilfred's AAUP contributions were solid, significant, and sometimes innovative," says colleague Ralph Loomis, Professor Emeritus of English. "His devotion to University governance was unstinting and unflagging." At the UM he played an important role in faculty governance, serving as vice-chair of the Faculty Senate (SACUA) and as as chair of an AAUP committee for annual review of the UM budget. In 1986, he was one of the inaugural recipients of the Distinguished Faculty Governance Award presented by SACUA. In 1990 he helped to establish the Academic Freedom Lecture Fund (AFLF), which sponsors an annual lecture in honor of three University of Michigan professors fired or suspended for political reasons during the McCarthy era, and he remained on the AFLF Board of Directors until his death.

Wilfred and Heidi's children Roland and Muriel were born and raised in Ann Arbor. Wilfred and Heidi greatly enjoyed playing music together and in various chamber groups. He played the violin, piano, viola, and zither; she the cello and piano. Wilfred did much to promote the arts, especially music and drama, in the Ann Arbor area. He served as president of the Dramatic Arts Center, president of Ars Musica, and president of the Washtenaw Council for the Arts. In addition to music, Wilfred and Heidi devoted their leisure time to avid reading of classical literature in many languages. They never owned a television set.

In recent years, Wilfred Kaplan served as President of the University of Michigan Retirees' Association, and his work greatly strengthened that organization. Following the loss of his beloved wife Heidi in 2005, Wilfred worked to edit and translate their collection of correspondence with each other and with family and friends. Two volumes of these edited letters have been printed, and another is forthcoming.

Wilfred Kaplan will be remembered as a cultured man with many talents and a broad range of interests and accomplishments. He dedicated much of his life to the service of his profession, his university, and his community. He is survived by his brother Robert Kaplan of New York, his sister Esther Kaplan Braun of Boston, his children Roland Kaplan of San Jose and Muriel Kaplan Zwiebel of Minneapolis, four grandchildren, four great-grandchildren, numerous nieces and nephews, and a large community of colleagues and friends. All were witness to his intelligence, compassion, generosity, and love of life.

Many Thanks to our Generous Supporters

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Alumni Voices

Algebraic Equations and Finite Simple Groups: What I learned from graduate school at the University of Michigan, 1964–1967, by Michael Fried

Michael Fried (PhD 1967) *spent 26 years as a member of the Mathematics faculty at the University of California, Irvine. During his career, he received a Fulbright Fellowship and a Humboldt Award. He has contributed this story as part of our ongoing history project, and an expanded version of the article is available on our History webpage www.math.lsa.umich.edu/information/depthistory.shtml. The full detail of this story is available on Fried's webpage: www.math.uci.edu/~mfried/paplist-cov/UMStory.html.*

PRELUDE: After three years of Graduate School in Mathematics at University of Michigan (1964-1967), writing a thesis under the direction of Don Lewis, I left for a postdoctoral at the Institute for Advanced Study. There I studied with Goro Shimura. My first year was extended to two years (1967-1969). Then, I went with James Ax to SUNY at Stony Brook. After receiving tenure and a Sloan Fellowship, I left. That bare bones outline of a beginning career tells little mathematically.

It has no hint that the work inspired by my time at UM connected resolutely with the simple group classification—through conversations with John Thompson—and with modular curves—interactions with J.P. Serre. Nor, that problems of Andrzej Schinzel and Harold Davenport, (visitors to UM my second year) in papers with Lewis, were the inspiration. Not even that technical tools came from assiduous use of Grothendieck's fiber product approach to algebraic equations. Yet, fulfilling those connections required–no word better–tutoring from many UM-affiliated faculty during my formative years.

This short version of the story relates Davenport's Problem, the steps in its solution, and how the connections above came about. I never lost my youthful enthusiasm for completing programs of Abel, Galois and Riemann, as recorded in "What Gauss told Riemann about Abel's Theorem" (http://www.math.uci.edu/~mfried/paplist-cov/Wh-Gauss-Tld-Riem-ab-Abel.pdf).

DAVENPORT'S PROBLEM AND FIBER PRODUCTS: When number theorists say almost all primes p, they mean all but finitely many. Davenport sought relations between two polynomials $f(x)$ and $g(y)$ with rational coefficients—where no change of the variable in f gives g—having the same ranges on integers mod p for almost all p. He liked this style of question, and often used exponential sums to interpret it.

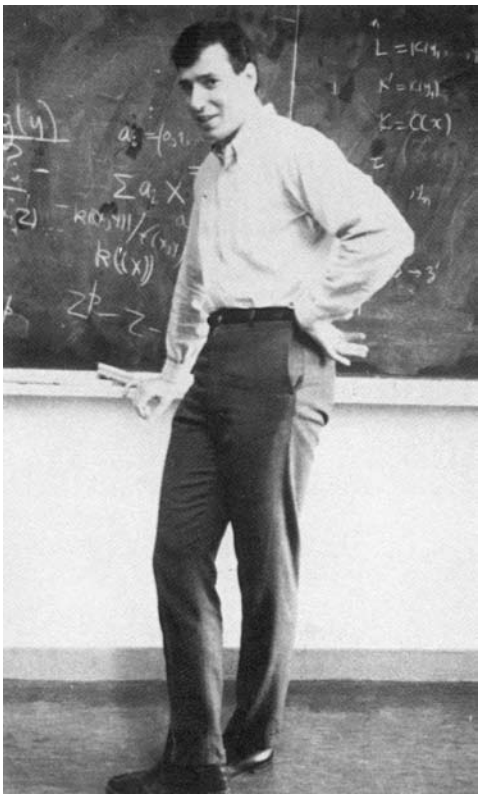
Changing "almost all" to "infinitely many" and taking $g(y)=y$, restates the hypothesis of Schur's 1921 conjecture. The conclusion of Schur: f must be composed of linear, cycle and Chebychev polynomials. Richard Brauer was a student of Schur, and advisor of Don Lewis. When I met him he asked if I knew he had worked on Schur's conjecture. I hadn't.

A variables-separated algebraic equation looks like $f(x)$-$g(y)=0$. Writing this as $f(x)$-$z=0$ and $g(y)$-$z=0$ opened the territory. Fiber products of f and g over the z-line allowed me to use groups to draw conclusions. I'll use n for the degree of f. Visiting Assistant Professors Armand Brumer and Richard Bumby guided my mastering Grothendieck's Tohoku paper and pieces of his EGA. There I learned to go between algebraic equations and group theory.

Chuck MacCluer's thesis, under Lewis, showed—for special f—a geometric statement gave Schur's one-one mapping hypothesis. Later, by extending the Chebotarev density theorem, I formulated a general context including Davenport and Schur. There, pure group theory translated the number theory.

Formulations, however, are not conclusions. Could you invert the direction polynomials to groups, as in Schur's Problem?

A rational function not composed of lower degree functions is indecomposable. I state lightly what I found powerful in practice: (i) A rational function's covering group is primitive exactly when the function is indecomposable; (ii) A polynomial's covering group always contains an n-cycle.



Michael Fried, circa 1968. Photo courtesy of the American Mathematical Society.

From that I learned, that if f was indecomposable, its covering group was either doubly transitive, or f was in the Schur conclusion. That finished the Schur story and deepened the Davenport story.

I now knew Davenport's hypothesis on f and g produced a difference set mod n that encoded how zeros of $g(y)$-$z=0$ summed to a zero of $f(x)$-z. Not only did the distinct permutation representations for f and g have the same degree, their group representations were identical.

I had seen Brumer pepper Jack McLaughlin with group theory questions. When Brumer left for Columbia in 1966, I took his place with McLaughlin, from whom I learned the distinction between doubly transitive and primitive. Richard Misera, a fellow grad student working with Donald Higman, saw this interaction and gave me a propitious example, coming from projective linear groups. I applied this, modulo something that I learned very much on my own—R(iemann)'s E(xistence) T(heorem)—to produce polynomial pairs having almost simple groups with special projective linear core. The three propitious points were these:

1. Without writing equations, I was able to see the Galois action of the cyclotomic field of n-th roots of 1, acted on the difference set relating f and g. The elements that preserved that difference set, up to translation (so-called multipliers), gave the definition field of the pair (f,g). Further, -1 was never a multiplier, so that definition field was never Q.

2. Because the covers given by f and g had genus 0, the only possible degrees for f and g were n=7, 11, 13, 15, 21, 31.

3. The cases with infinitely many essential pairs (f,g) modulo mobius action on z, x and y appearing in #2, had degree 7, 13 and 15. Further, in these cases those essential parameters formed a genus 0, upper half-plane quotient, that wasn't a modular curve.

Tom Storer, newly at UM when I visited it from IAS, worked with me on the last statement of #1. This completed Davenport's Problem over Q for indecomposable polynomials f. There were no nontrivial examples. It used nothing from the simple group classification. The offshoot of that technique became the Branch Cycle Lemma, the most practical tool by which to relate geometric covering groups and definition fields.

The longer version of this article has these further sections: Using the classification and the genus 0 problem; UM seminars and modular curves; The significance of Davenport's problem. These tell why Davenport's problem had an impact (in order) in well-known papers of Thompson, Serre, and Denef and Loeser.

Of the others who got PhDs in 1967, one became much more famous than anyone who might be reading this. That was "The Unabomber," a no-show at the going away party Paul Halmos gave us. The picture on the opposite page is from Halmos' "I Have a Photographic Memory" (American Mathematical Society, Providence, RI, 1987). I was standing in front of my diagram for the Schur Conjecture proof at the end of my 1968 UM lecture on it.

I didn't know about that picture until years later. Still, either I, or the Schur Conjecture, must have been funny. A New Yorker not long afterwards had a cartoon based on it. I have seen only one person from my graduate years more than once after grad school. That was the topologist Bob Edwards who twice sat in on talks of mine at AMS conferences.

Solution to Math Problem

There will be a final string of beans of the same color (the color of the last bean drawn), and then a bean preceding it of a different color. The desired probability p is that these two colors are blue and green or green and blue, respectively. The probability that the last bean drawn is blue is 300/600 = 1/2, and, no matter how long the final string of blue beans is, the probability that the bean of preceding color is green is 200/(100+200) = 2/3. For green and blue these numbers become 200/600 = 1/3 and 300/(100 + 300) = 3/4. Thus, p = (1/2)(2/3)+(1/3)(3/4) = (1/3)+(1/4) = 7/12.

Share Your Stories

We would like to include your stories and remembrances on our History website www.math.lsa.umich.edu/information/depthistory.shtml. We have recently begun in earnest to collect and share some of our Department's history. Over the years many documents have been written about the educational, scholarly, administrative and research activities of U-M mathematics, and we invite you to share the history.

Beyond the facts, figures and remembrances of faculty members, the history of the Department is contained in its students. We are interested in your memories of your time as a student. What impressed you about your first or hardest math class? Did a discussion during a seminar help to establish the direction of your significant research? Who were your most memorable instructors? Do you have a story about one of the faculty members that might enlighten others to their spirit? How did they help shape your educational career and influence your life? Do you have a story about Tom Storer, Maxwell Reade, T. H. Hildebrandt, George Piranian, or any other Department member that stands out in your memory?

Please send us your remembrances and we will make an effort to share them with others. If you would like your remembrances to be included in ContinuUM or on our website, we will work with you to include your memories.

Michigan Today is also seeking your stories. You can share your stories and read those of others on this website http://michigantoday.umich.edu/heritage.php.

We Need You!

Want to get involved with the UM Department of Mathematics? Here are some areas where alumni participation is vital. Contact us if you are interested in working with us on these initiatives.

- Recommend the UM mathematics program to students interested in undergraduate or graduate studies
- Participate in our annual Career Day, held each year in early November
- Visit the Department for afternoon tea (weekdays at 3:45 sharp) if you are in town for the weekend, including Homecoming, Parent's weekend, or the Presidential Society weekend
- Be a mentor (in person or via email) to a current student
- Set up a recruiting program with your company for graduating students
- Offer internships in your company to mathematics students
- Allow groups of mathematics students to visit your company
- Give an informal talk to mathematics students about how you have used your math knowledge

Email math.mich@umich.edu
or call 734-647-4462

Upcoming Events

Department Colloquium

Every Tuesday at 4:00

Mathematics Career Conference

November 14, 2008

Alexander Ziwet Lectures

November 18-20, 2008

Ioannis Karatzas

University of Columbia

"Some Stochastic Control Problems in Mathematical Finance"

Michigan Reception

Joint Mathematics Meetings

American Mathematical Society

Washington, D.C.

January 6, 2009

2009 Michigan Math and Science Scholars Summer Program

Two sessions for qualified high school students:

June 28 - July 10 and

July 12 - July 24

Please visit our website for additional information on these and other events in the Department. www.math.lsa.umich.edu.

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Where's Your Math Department T-shirt Been?

We'd like to know where you show off your your Math affiliation. Above, Department Administrator Doreen Fussman shows her spirit while serving in Iraq. Wear your Math t-shirt while travelling, snap a photo, and email the picture and a description of where you are to math.mich@umich.edu. We'll try to include it in the next newsletter, and include it on our webpage here http://www.math.lsa.umich.edu/undergrad/Tshirts/Tshirts%20destination/

Don't have a Math t-shirt? Stop in the Department some time and pick one up for just $5. Or email math-ugrad-office@umich.edu to arrange to order one and have it sent to you by mail. They are available in several colors and sizes. Your purchase will help support undergraduate program activities.

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Matching funds still available

There is still time to take advantage of the President's Challege for Graduate Student Support. Until the end of 2008, all gifts to funds designated to support graduate students will be matched at a 50% level. For every two dollars given to a fund supporting graduate students, one dollar will be endowed in a departmental fund for future graduate student support. The Mathematics Department has an expendable graduate student support fund (code 312378) or several named endowments that also are designated for graduate student support. If you are contacted by the University of Michigan for a donation, you can earmark your gift to the Department of Mathematics. We greatly appreciate all of your support, and we hope we can count on you to support future fundraising projects.

Estate Gifts

You may include the Department of Mathematics in your estate plan. Please call us at 734-647-4462 for information on charitable trusts and bequests to the department, or contact:

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Conference in Honor of Mel Hochster

In August 2008, over 100 mathematicians gathered to celebrate Mel Hochster's 65th birthday at a conference titled "Commutative Algebra and its Interactions." Conference participants included Mel's students, collaborators, former post-docs, and other colleagues from around the world. The conference included six days of talks on commutative algebra, a reception, a conference banquet, and of course a Sunday afternoon gathering to play bridge. Information about the conference proceedings is available on our website here http://www.math.lsa.umich.edu/conferences/hochster/index.html.

In conjunction with the conference, the Michigan Mathematical Journal published a special 755 page special volume in honor of Mel. The volume includes 44 articles from over 80 authors. The volume may be purchased for $50 from the Michigan Mathematical Journal (michigan.math.j@umich.edu).

Conference participants included many of Mel's 33 graduate students. Some of the students who attended the conference are pictured above, from left to right: Emily Witt, Hailong Dao, Geoffrey Dietz, Adela Vraciu, Florian Enescu, Bruce Fields, Mel Hochster, Anurag Singh, Moira McDermott, Karen Smith, Ian Aberbach, Sankar Dutta.

Right: Conference organizers Karen Smith, Craig Huneke, and Anurag Singh are pictured with Mel and the special volume published in his honor by the Michigan Mathematical Journal.

What Are You Doing?

We'd like to hear from you! Please complete and return this form for our alumni/ae files. You may mail it to the address below, fax it to 734-763-0937, or email the information to math.mich@umich.edu. See www.math.lsa.umich.edu/alumni/

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