



Newsletter of the School of Mathematics University of Minnesota

NO. 4

FOR ITS MEMBERS, ALUMNI, AND FRIENDS

JANUARY, 1998

FROM THE DEPARTMENT HEAD

The School of Mathematics has been passing through a very successful and at the same time eventful period.

My colleagues in the School and I feel very proud that two of our colleagues, Professors Maury Bramson and Mikhail Safonov, have been invited to address the International Congress of Mathematicians (ICM) to be held in Berlin in August 1998. It is considered a great distinction in mathematics to be invited to address the ICM, which is held once every four years. Among other highly notable honors bestowed upon our faculty are the "Distinguished Service to the Profession" Award received by Regents' Professor Avner Friedman from SIAM, and the 1997 Göran Gustafsson Prize awarded to Professor Dennis Hejhal.

We are also very fortunate to have attracted two new young faculty members, Assistant Professor Rachel Kuske and Associate Professor Fernando Reitich, who add substantial strength to our industrial and applied mathematics programs.

Our new Master's programs in industrial mathematics and in mathematics education are turning out to be very successful as far as job placement is

concerned. The new Calculus Initiative program, which combines active learning with a technology-based curriculum, and the new course for elementary school teachers have been highly successful. We are now in the process of introducing a new calculus course for biological sciences, which has been developed by Associate Professor Claudia Neuhauser, another very gifted recent addition to our faculty.

Two major national centers, the Geometry Center and the IMA (Institute for Mathematics and its Applications) are affiliated with the School of Mathematics. The Geometry Center has entered a phaseout period and will be sorely missed. The computer labs for our Calculus Initiative were developed at this center, which also provides state-of-the-art computer software for math visualization. The IMA now has a new director, Professor Willard Miller, Jr., who led the School of Mathematics to new heights while serving as its head for eight years. Willard succeeds Regents' Professor Avner Friedman, who decided to step down after eleven years of highly distinguished service as director of the IMA.

I must report a very sad event that

jolted us all in the School. Last May Professor Eugene Fabes passed away very unexpectedly at the age of sixty. The void left by his passing will be very difficult to fill. A symposium in memory of Eugene Fabes and Nestor Rivière, another highly esteemed colleague and a close collaborator of Gene who died at a very young age, will be held annually beginning in 1998. Another sad event to report is the terminal illness of Professor Jesus Gil de Lamadrid who served the School with distinction for forty years.

Institute of Technology Professor Hans Weinberger has decided to retire at the end of the present academic year. Among many other accomplishments, Hans served as the first director of the IMA. Professor Leon Green will also retire in June after a long and distinguished service to the School. We all offer them our best wishes for a productive and enjoyable retirement.

Naresh C. Jain

In this Issue

Faculty News	2
Celebrations	3
Undergraduate Program . . .	4
Graduate Program	5
Affiliated Centers	7

INCOMING FACULTY

Two outstanding young faculty members have joined the School in September 1997. They are:

▼Assistant Professor **Rachel A. Kuske**. She received her Ph.D. from Northwestern University in 1992 and came to us from Tufts University. She also held NSF and NATO Postdoctoral Research Fellowships at Stanford and the University of Utrecht, as well as a Szegő Assistant Professorship at Stanford. Professor Kuske works in applied mathematics. Her research interests are in nonlinear dynamics, specifically laser dynamics and pattern dynamics, and stochastic processes, including waves in random media, mathematical finance, and noisy nonlinear interactions. She works closely with our Minnesota Center for Industrial Mathematics (see the description of the Center's activities below).

▼Associate Professor **Fernando Reitich**. He received his Ph.D. from the University of Minnesota in 1991. His thesis advisor was Regents' Professor Avner Friedman. He came to us from North Carolina State University. He also held the Zeev Nehari Assistant Professorship at Carnegie Mellon University for three years. Professor Reitich works in applied mathematics and his research interests span a broad range of areas in partial differential equations, with emphasis on the analysis of models for the mechanical, thermodynamical and optical behaviour of materials.

MAJOR HONORS AND RECOGNITIONS

▼Professor **Maury Bramson** will be an invited speaker at the International Congress of Mathematicians to be held in Berlin in August 1998. Professor Bramson is currently working on topics in queueing theory. Models in queueing theory arise in the analysis of congestion and delay in computer systems, communication networks, and manufacturing systems. One important approach to the analysis of such structures is heavy traffic theory, where one employs Brownian motion-like approximations. To justify such approximations,

one needs a form of "state space collapse", where the relevant stochastic processes are restricted to appropriate subspaces. Bramson's recent work gives conditions for state space collapse of a general class of models. He will talk about this material at the International Congress.

▼Regents' Professor **Avner Friedman** received the "Distinguished Service to the Profession" award from the Society for Industrial and Applied Mathematics (SIAM). In the 45-year history of SIAM, only two such awards were given in the past; the recipients were Edward Bloch and Gene Golub. On May 1-3, 1998, the School of Mathematics and IMA will hold a conference to celebrate Professor Friedman's 65th birthday (see elsewhere in the Newsletter).

▼Professor **Dennis Hejhal** is the recipient of the 1997 Göran Gustafsson Prize. The prize includes research support of approximately \$150,000 per year for three years. Professor Hejhal was cited for his work on prime numbers and quantum chaos. The prize was officially presented on June 4, at the Royal Academy of Sciences in Stockholm. Professor Hejhal was also elected a foreign member of another organization, the Royal Society of Sciences of Sweden. He plans to use part of the prize money to support his joint work with A. Selberg in the area of zeta functions.

▼Professor **Rachel Kuske** was awarded a McKnight Land-Grant Professorship. These Professorships are two-year appointments with substantial research support made available to tenure-track faculty at the U of M and are awarded following a University-wide competition.

▼Professor **Wei-Ming Ni** was an invited one-hour speaker at the regional meeting of the American Mathematical Society held in Milwaukee in October 1997. The title of his address was "Spike-layers in nonlinear diffusion systems."

▼Professor **Mikhail Safonov** will be an invited speaker at the International Congress of Mathematicians to be held in Berlin in August 1998. The

main area of research of Professor Safonov is the theory of elliptic and parabolic partial differential equations of second order with discontinuous coefficients. Such equations have numerous applications to heat-mass transfer problems, chemistry, porous media, traffic flow and biology, to mention a few. They also serve as the foundation of the modern theory of fully nonlinear equations, which is closely related to the theory of optimal control of diffusion processes. At the International Congress in Berlin, Professor Safonov is going to talk about the major advances in this area during the last decades.

PROMOTIONS

Bernardo Cockburn was promoted to Professor effective September 1997. **Victor Reiner** was promoted to Associate Professor effective September 1997. He currently holds a McKnight Land-Grant Professorship and a Sloan Foundation Fellowship and is devoting the 1997-98 academic year to his research.

RETIREMENTS

Professor **Leon Green**, who has been at the School of Mathematics since 1953, will retire this June. His specialties are Differential Geometry and Dynamical Systems. Leon's distinguished career has included visiting appointments in Paris, Zürich, as well as Yale University and the University of California. He was a co-author (with the late L. Auslander and F. Hahn) of "Flows on Homogeneous Spaces", and he authored the famous paper "Auf Wiedersehensflächen", *Annals of Math.* 1963. Leon will be missed by his colleagues and students at the University.

Institute of Technology Professor **Hans Weinberger** has decided to retire from regular service as of the end of the current academic year (1997-98).

Hans has a very active research program in applied mathematics and partial differential equations, and has always participated in innovative teaching programs. Those who know

Hans expect he will continue his research even after retirement. He will be missed in many ways. Hans joined the department in 1960. Throughout his career at Minnesota, he played a leading role in the School. He was Head of the School of Mathematics 1967-69. He was also the founding director of the Institute for Mathematics and its Applications (IMA), 1981-86. He has published some 90 research articles in very prestigious journals, and served on the editorial boards of several leading mathematics journals. He also published two research monographs and an undergraduate text in partial differential equations which has served the needs of many undergraduate and graduate students in science and engineering.

Professor Weinberger was honored last April for his contributions to the School of Mathematics and the IMA at a conference entitled "Future

Directions in Mathematical Sciences".

Naresh C. Jain

ACADEMIC VISITORS

Visiting Assistant Professors

The following new Visiting Assistant Professors are spending all or part of the 1997-98 academic year with us: Radha Kessar (Ph.D. from Ohio State, Group Theory), Martin Kruzik (Ph.D. from Charles University, Numerical Analysis), Shari Moskow (Ph.D. from Rutgers, Applied Mathematics), Moxun Tang (Ph.D. from University of Alberta, Differential Equations) and Tim Zajic (Ph.D. from Stanford, Probability.)

The ITCEP Postdoctoral Visitors

The following ITCEP (IT Center for Educational Programs) Postdoctoral Visitors also participate in the teaching activity of the School of

Mathematics: Harel Barzilai (Ph.D. from Cornell), Cindy Kaus (Ph.D. from Brandeis), Mike Lawler (Ph.D. from Brandeis), and Daniel O'Loughlin (Ph.D. from University of Minnesota).

Ordway Visitors

The Ordway Visitor Program of the School brings distinguished mathematicians to Minneapolis for one month to lecture and interact with faculty and students. The 1997-98 academic year visitors are:

Kung-Ching Chang, Beijing University, November 1997; Johan de Jong, Princeton University, January 1998; Ciprian Foias, Indiana University, Jürgen Moser, ETH Zürich, April 1998; Lawrence Smith, University of Göttingen, March 1998; Gang Tian, MIT, April 1998; V.S. Varadarajan, UCLA, April 1998

Professors Foias and Moser will also be visiting the IMA.

Long-Term Visitors

Boris Levitan (Minneapolis), Inverse problems for Sturm-Liouville systems; Pasi Mikkonen (University of Jyväskylä, Finland), Nonlinear Potential Theory; Fumihito Oda (Hokkaido University, Japan), Group Theory.

CELEBRATIONS

Regents' Professor Emeritus Larry Markus' 75th birthday celebration took place October 30. Professor Markus gave a Colloquium lecture titled "Symplectic Geometries for Differential Operators". The lecture was followed by a dinner at the Campus Club. The speakers commented on Professor Markus' outstanding contributions to mathematics, his wide ranging mathematical interests, his availability to colleagues and students, and his great sense of humor.

Future Directions in Mathematical Sciences Conference

The School of Mathematics and the IMA held a conference on April 18-20, 1997 to honor five distinguished members of the School Faculty, Professors Donald Aronson, Walter

Memorial to Eugene Fabes, a major figure of our School

Eugene B. Fabes, a leading mathematician and recent Head of the School of Mathematics, died suddenly May 18, 1997, at the age of sixty, two days after suffering a heart seizure while walking on campus. His passing is a major loss to the School and mathematical community.

Gene, as he was known to his many friends, joined the School in 1967 after two years at Rice University. He had completed his Ph.D. thesis in 1965 under the direction of the eminent mathematician Antoni Zygmund at the University of Chicago. He had a very active research career and collaborated with many mathematicians in the U.S. and abroad. Gene was a special person, with tremendous warmth and enthusiasm, and seemed to bring out the best in his collaborators as well as his many students. The connections he maintained with his former students and other researchers around the world were very beneficial to his own department. Though his greatest devotion was to teaching and research, he spent a good part of a number of years contributing to the administration of the School, including serving as Head. He was active and decisive as Head, and very supportive of the many new programs which help to make our School a major resource for the mathematical, as well as the larger, community.

The School of Mathematics held a memorial service for Gene on October 18, 1997, marked by many scientific tributes and even more of a personal nature. He will also be remembered through an annual lecture series held to honor him and the late Nestor M. Rivière, who was a collaborator of Gene and a close friend and colleague (see elsewhere in this Newsletter concerning the Rivière-Fabes Memorial Symposium).

He is survived by his wife Esther, children Ellen, Brian, Catherine, Mary Beth and Matthew, two grandchildren, Noah and Ethan, and brother and sister Norman and Estelle.

Naresh C. Jain

Littman, Willard Miller, Jr., George Sell and Hans Weinberger on their respective birthdays. They were recognized for their outstanding contributions to research and teaching in the School of Mathematics and to the mission of the IMA.

UPCOMING CONFERENCES

The Rivière-Fabes Memorial Symposium

The Rivière-Fabes Memorial Symposium has been established to honor two distinguished members of the School of Mathematics, the late Eugene B. Fabes and the late Nestor M. Rivière who were close mathematical collaborators and friends.

The new Memorial Symposium will continue, in an expanded form, the Nestor M. Rivière Memorial Lecture which has been held annually since 1987. Gene Fabes passed away May 18, 1997 (see tribute to him elsewhere in this Newsletter). The new Symposium has been made possible by donations from friends and colleagues of Gene and Nestor to the University of Minnesota Foundation in memory of Gene Fabes. Persons wishing to contribute to the symposium should send donations to the University of Minnesota Foundation, 1300 South 2nd Street, Suite 200, Minneapolis, MN 55455, with a cover note explaining that the donation is for the Rivière-Fabes Fund.

The first Rivière-Fabes Symposium on Analysis and PDE will be held at the School of Mathematics on April 4th and 5th, 1998. The principal speakers will be Carlos Kenig (University of Chicago), who will give two lectures, Nicola Garofalo (Purdue University) and Zhongxin Zhao (University of Missouri-Columbia). Additional information can be obtained from Max Jodeit (jodeit@math.umn.edu). See also <http://www.math.umn.edu/arb/RFPo ster.html> or just go to <http://www.math.umn.edu/> and look for the link Rivière-Fabes Symposium on Analysis and PDE on the School of Mathematics Home Page.

Yamabe Memorial Lecture

The Tenth Yamabe Memorial Lecture will be given May 28, 1998 by Professor Peter Sarnak of Princeton University. He is well known for his work in number theory, differential geometry and functional analysis.

Pure, Applied and Industrial Mathematics: Strength through Connections

The School of Mathematics and the Institute for Mathematics and its Applications (IMA) will hold a conference on May 1 - 3, 1998 to celebrate the 65th birthday of Regents' Professor Avner Friedman. The current list of speakers includes L. Caffarelli, P. Castro, E. DiBenedetto, W. Fleming, J. Glimm, W. Littman, H. Ockendon, J. Ockendon, Z. Usiskin and J.J.L. Velázquez.

Nonlinear Partial Differential Equations and Continuum Mechanics Conference

The Conference is organized by Professors Richard James from the University of Minnesota Aerospace Engineering Department, Stefan Müller from the Max Planck Institute (Germany) and Vladimir Sverak of the School of Mathematics and is supported by funds from the Max Planck prize awarded to Professors Müller and Sverak by the Humboldt Foundation. The Conference will be held June 8-12, 1998 at the School of Mathematics.

The invited speakers are: S. Antman (Maryland), K. Bhattacharya (Caltech), P. Constantin (Chicago), B. Dacorogna (Lausanne), C. Dafermos (Brown), Weinan E (Courant), L. C. Evans (Berkeley), M. Esteban (Paris Dauphine), J. Ericksen, G. Friesecke (Oxford), P. Holmes (Princeton), I. Kukavica (Chicago), D. Kinderlehrer (CMU), M. Luskin (U of M), J. Marsden (Caltech), F. Murat (Paris 6), L. Nirenberg (Courant), F. Otto (UCSB), Z. Xin (Courant) and L. C. Young.

UNDERGRADUATE PROGRAM

Calculus Initiative

The Calculus Initiative continues to expand. This year over 400 undergraduates are enrolled in the 2-year calculus sequence, *Concepts, Explorations, and Applications*. The initiative provides students with an enriched experience in calculus, including smaller sections, active learning, use of appropriate technologies, and group work and lab based projects focused on applications. See also page 5 for a first hand report by Professor Larry Gray about his involvement in this program.

Conversion to Semesters

The School of Mathematics, along with all other departments, is in the process of planning for semester conversion. Mathematics, however, has a special burden not shared by some other departments: many of our courses are year-long sequences which don't necessarily start in the Fall Quarter. We are taking steps to ensure that as few students as possible are caught in the middle of a sequence when the conversion to semesters takes place, and we plan to make special arrangements so that those students who are caught in the middle can complete their program with a minimum of inconvenience.

Good Teaching Awards

The following Teaching Assistants received the Good Teaching Awards for the year 1997: David Bailey, Pavel Belik, Bess Dawson-Schmidt, Robert Hesse, Peter Ketcham, Kendra Killpatrick, Namyong Lee, David Norman, Philip Osterlund, Carrie Rowland, Jeffrey Schaefer and Uli Walther.

New Course for Elementary School Teachers

Over the past several years, Professor Dennis White has been involved in a major revision of the School's offering for elementary education majors. In this important undertaking he has received assistance and input from several members of the School, including Professors Paul Edelman, the late Gene Fabes, Bert Fristedt,

Lawrence Gray, Harvey Keynes, Richard McGehee and Richard Moeckel. Several teaching assistants have also been involved. These revisions involve both a major upgrading of the contents of the course as well as pedagogical innovation. The old two-quarter sequence at the 1000-level has been upgraded to a year-long sequence at the 3000-level (Math 3105-6-7).

The class has an active learning environment, involving students breaking up into small working groups, and presenting their solutions on the blackboard. Over the past few years the student interest in the course has grown enormously. Currently there are 80 students registered in this course. We feel strongly that these students will take the experience from this class back to their own classrooms as teachers.

Scholarships

The School has awarded a total of about \$22,000 in scholarships to undergraduates during 1996-97.

*David Frank,
Director of Undergraduate Studies*

Actuarial Program

One year ago in this space, we offered these numbers about the actuarial program: 23 students in Actuarial Math (F96) and 11 placements (so far) in 1996. This year we have a slightly smaller actuarial class of 19. Six members of our present class are now formally enrolled in the new Carlson School "Actuarial Science" major, though they continue to take their actuarial courses in the School of Mathematics.

On the positive side, the final placement count for 1996 was a record 14, which has swelled the historical placement total to 161. This is 54% of total participants, up from 51%. This 161 represents 73% of those who ever passed an actuarial exam (221), which number in turn is 75% of total participants since 1983 (296).

We are also pleased about the continuing professional advancement by our former students. Of the total of 70 working program participants who graduated in or before 1990, 31

have become full Fellows. A sign of the times for graduate students in Math: the profession has hooked four of ours from the last two years, to wit Michelle Haines, April Giesler, Steve Nelson, and Ernesto Schirmacher.

Of course, there have been many others over the years; some of our graduates who are Fellows of the Actuarial Society of America include Jim Romanowski, Bill Oostendorp, Charlie Caswell, Joe Schumi, John Zicarelli and Julia Philips.

*Steve Agard,
Actuarial Program Coordinator*

GRADUATE PROGRAM

A new program, the Ph.D. with emphasis in Applied and Industrial Mathematics, was approved last year. Several students are working toward that degree. The M.S. degree with emphasis in Mathematics Education is in its second year, and we expect that five students will graduate at the end of Summer Session, 1998. The

Calculus Initiative - a personal view of a faculty member

I would like to give an entirely personal (but I hope thoughtful) view of the Calculus Initiative program. I taught the first-year sequence in 1996-97 and am teaching the second-year sequence in 1997-98. Since I was not very heavily involved in the initial planning and development of the program, I began as an outsider. I am now very much a supporter.

Here are the chief differences between the Calculus Initiative and our traditional calculus sequence. (1) The in-class time is structured differently, with 2 hours of large lecture, 1 hour of recitation, and 2 hours of lab/workshop each week. Thus, some of the learning of material must take place in the lab/workshops, where there is an emphasis on "learning by doing". (2) Graphing calculators are an integral part of first year instruction, and Mathematica and Matlab are an integral part of the second year, thereby allowing us to assign problems and projects that cannot be done reasonably in a traditional course. (3) The students are required to write more. For example, in the 4-th quarter course this year, we have required that they individually write up 4 labs. (4) The structure of the program encourages improved contact among all participants (faculty, TAs, students, administrative staff). This is perhaps the most important difference in my view. In a typical week, I spend 30 minutes to an hour discussing the progress of the course with the TAs, about the same

amount of time working with the other instructor, 2 hours in lab/workshop with the students, in addition to the more traditional lecture and office hour time. And I feel that this is all time well-spent. The administrative staff is directly involved and very cooperative. One could envision the traditional calculus sequence working this way, but I think that it currently typically does not.

What is my evidence that the differences are worthwhile? First of all, the return rate from first year to second year is very high (around 85 percent). Since the students have the option at any time to go back to the traditional sequence, this figure is impressive. Second, the performance level is high, with very few students earning less than a 'C' grade.

The TAs and faculty involved in the program generally agree that the students seem to be working hard and performing well. (We do not have long-term data yet to document performance-level.) And finally, there seems to be a high level of satisfaction among all concerned.

There is no doubt that it is possible for a good teacher to give an excellent calculus course under a variety of formats, including the traditional one. But I personally feel that the Calculus Initiative program has made me a better and more effective teacher than I have been in our standard calculus classes.

Larry Gray

students will also receive licensure to teach in high schools in Minnesota.

Between September 1996 and September 1997, fifteen students received their Ph.D. degrees in mathematics and another two completed their final exams. Including two who were hired as Teaching Specialists, all are employed. The most successful student won a year at the Institute for Advanced Study, to be followed by an introductory position at UCLA. The outstanding thesis award was shared between Michael Chu in geometric analysis and Aaron Hagen in differential equations.

T.P. Tsai received an Alfred P. Sloan Doctoral Dissertation Fellowship.

After consultation with specialists in all the areas represented in the School of Mathematics, we have converted our graduate offerings to a semester basis, which will begin in fall 1999. In some cases, substantial changes were made. The details are available on the web or from the Graduate Program secretary at 612-625-1306.

*Donald Kahn,
Director of Graduate Studies*

New Computing Laboratory in Vincent Hall

A state-of-the-art computing laboratory has been constructed on the third floor of Vincent Hall. The laboratory will be used to enhance several new courses. This project is led by faculty members in Numerical Analysis and will benefit students (and faculty) in industrial and applied mathematics.

Funding for the laboratory came in part from the National Science Foundation through its Group Infrastructure Grant program. The computer lab will be used in developing innovative approaches to teaching computational mathematics. The laboratory will also play an important role in research in applied and industrial mathematics.

*Fadil Santosa
Associate Director, MCIM*

THE MATHEMATICS LIBRARY

There is good news and there is bad news. The good news is that we have a very good new librarian, Kristine

Fowler. Kris has a Bachelor's degree from Carleton College, and two Master's degrees, one in physics and the other in library science, both earned at the University of Illinois. Most recently, she was the mathematics and physics librarian at the University of Wyoming. Kris would like to know the mathematics faculty, so next time you are in the library please introduce yourself to her. Now for the really bad news. Due to budget cuts, the mathematics library, as a research library, is on a downhill slide. When an important new journal appears we cannot order it without canceling another journal to pay for it. Our budget for ordering books, except for series with standing orders, has also decreased dramatically.

During the 1995-96 and 96-97 academic years, we cut about \$20,000 in journal subscriptions. Last year we were required to cancel \$19,000 in journal subscriptions for 97-98. Thanks to funds provided by the School of Mathematics and the IMA, these cuts were delayed by one year. These funds from Math and IMA were available only temporarily since these units, especially the department, have budget cuts and problems of their own.

The legislature has given money to Minitex, which is expected to provide electronic access to all Academic Press journals. Academic Press will then give us a 75% discount on all of the paper versions of their journals. This will reduce our cuts to about \$10,000. However, depending on the library budget for next year, we may be required to undertake another round of cuts. There does not seem to be an obvious solution to this problem and we face the prospect of having a second rate library in the very near future.

*Jay Goldman,
Chairman of the Library Committee*

New Sculpture in Mathematics Library

In 1991, on the occasion of the founding of the Geometry Center, the well known mathematical sculptor, Helaman Ferguson, created a marble sculpture representing a significant topological and geometrical

MINNESOTA CENTER FOR INDUSTRIAL MATHEMATICS

A Center in the School of Mathematics, Minnesota Center for Industrial Mathematics (MCIM), offers educational programs that provide students with broad training appropriate for the industrial and business workforce.

Center faculty and students collaborate in research with companies to provide solutions to mathematical problems in industry. The Center plays a key role in programs leading to M.S. and Ph.D. degrees in mathematics with emphasis in industrial mathematics.

This summer, the Center sent 8 graduate students to work as interns in companies in Minnesota, as well as nationwide. The companies participating in the program include Lucent, Schlumberger, Medtronic, Deluxe Corporation, LORAM, Ceridian, and Lockheed-Martin. The students work on research problems under the mentorship of industry scientists and faculty advisors. Upon returning to campus, students present seminars on their work and write M.S. theses which summarize their industrial projects. In addition, there are 3 Ph.D. students who are supported by industry over the academic year. The Center launched a program called the Undergraduate Industrial Mathematics Project last June. The program involves 13 honor students from the University of Minnesota and also from Carleton College and Hamline University. Students work in teams on research problems posed by local companies, and each team is supervised by an industrial mentor and a faculty member. This off-campus experience is aimed at providing the students with broader education and enhancing their communication skills. The students receive a small scholarship and get course credits for their work.

structure, known as M^3 . The sculpture, formally titled the "Thurston Hyperbolic Knotted Wye II", was recently donated by the Geometry Center to the Frederick R. Weisman Art Museum, and the Museum has kindly agreed to keep it on display in the Mathematics Library. A note discussing the mathematics behind the sculpture can be obtained from Professor Albert Marden (email to am@math.umn.edu) or from the Mathematics Library (email to library@math.umn.edu).

AFFILIATED CENTERS

Recent Developments at the IMA

The Institute for Mathematics and Its Applications (IMA) is located on the 5th floor of Vincent Hall. The IMA was established in 1982 by the National Science Foundation as a result of a national competition. An international Board of Governors oversees the activities of the IMA and approves budget and scientific programs. Furthermore the IMA is affiliated with the School of Mathematics, the Minnesota Center for Industrial Mathematics, as well as with about 40 Participating Organizations worldwide (universities and corporations).

The mission of the Institute is to close the gap between mathematics theory and its applications. The IMA hosts annual programs, each program chosen with the purpose of encouraging interaction between mathematicians and scientists from academia, industry and government laboratories. The general topic of the year is usually divided into two or three sub-topics on which the program concentrates for one to three months. This period is usually highlighted by many workshops. A typical yearly program is designed around a group of senior scientists who agree to be in residence for three to ten months. This allows continuity for the program as well as scientific guidance for postdoctoral members. The IMA also runs a series of shorter duration programs during the summer.

Industrial programming is also a very important part of IMA activity. The Institute runs a biweekly Seminar on Industrial Problems in which industrial scientists present problems to academic mathematicians. There is also an Industrial Postdoctorate program, half funded by the NSF and half funded by the sponsoring companies.

This has been an exceptionally eventful year in IMA history. After 11 extremely successful years as IMA Director, Regents' Professor Avner Friedman decided to step down. Avner remains as Director of the Minnesota Center for Industrial Mathematics (MCIM). As a result of a national search, Professor Willard Miller, Jr., Professor of Mathematics and Associate Dean for Finance and Planning in the Institute of Technology, was chosen to replace him. Professor Fasil Santosa, Associate Director of MCIM was also appointed as IMA Associate Director for Industrial Programs, with responsibility for the Seminar on Industrial Programs and the mentoring of Industrial Postdocs.

The 1997-98 annual program "Emerging Applications of Dynamical Systems" is proving to be highly successful and very well attended. Among the distinguished mathematicians in residence for the fall portion of the program on numerical analysis aspects of dynamical systems are John Guckenheimer (Cornell), Herb Keller (Caltech), Eusebius Doedel (Concordia University, Montreal) and Rafael de la Llave (Texas, Austin). The winter 1998 program on applications of dynamical systems to chemistry and physiology promises to be exciting, with workshops on topics such as Computational Neuroscience (January 14-23), Calcium Dynamics in Cells, (February 9-13) and Cardiac Rhythms (March 9-14). The spring program on symmetry and pattern formation will include workshops on Dynamical Systems in Oceanography (May 7-9) and Animal Locomotion and Robotics (June 1-5), among more traditional workshops.

At 7 p.m. on Thursday, April 23, 1998 in Physics 150, Professor Ian Stewart, Professor of Mathematics, University of Warwick, Coventry, England, will deliver the IMA Public Lecture entitled "Life's Other Secret" (The new mathematics of the living world). This talk is suitable for students of mathematics, from high school to faculty and postdoctorate research and concerns the vital, creative mathematics that now informs our understanding of life at every level - from DNA to rainforests, from viruses to flocks of birds, from the origins of the first self-copying molecule to the march of evolution.

The program for the summer of 1998 is Coding and Cryptography (July 7 - 17) and the 1998-99 annual program will be "Mathematics in Biology". The latter program will focus on topics in developmental biology, immunology, infectious diseases, physiology, ecosystems and epidemiology. For information about these and all IMA programs, contact the IMA at 612-624-6066 or at the Website www.ima.umn.edu.

Willard Miller, Jr. IMA Director

The Geometry Center

Science and technology centers have a finite life. The Geometry Center is in the middle of its phaseout period. It will cease operations as a National Science Foundation Science and Technology Center on August 31, 1998. During the phaseout, the Center's primary goal is to bring to completion the many software projects undertaken by the Center over the years. Two are described here. The first one, known as Geomview, is an interactive 3D viewing program written by Center staff. It allows the user to interact with a 3D scene by translating, rotating, and scaling objects in the scene, as well as by modifying appearance properties such as color and drawing style.

The second project, known as WebEQ is a mathematical typesetting package that provides a simple way to include mathematical notation in Web pages. The current methods of putting equations in Web pages are cumbersome, involv-

ing making separate image files for each expression, even if it is a single Greek character. By contrast, WebEQ allows authors to put commands in the Web page source file. The WebEQ program runs in the Web browser, and enables it to display the embedded notation. The resulting HTML documents are easy to edit, easy to read, and quick to download. A prototype version was shown at the Sixth International World Wide Web Conference on April 8, 1997, as a proof of concept. At that time, a preliminary version was made available to selected users. It has already found a number of commercial as well as academic users. To learn more about the Center's activities, see www.geom.umn.edu/.

Richard McGehee
Director of the Geometry Center

IT Center for Educational Programs (formerly Special Projects Office)

The Special Projects Office has become a new center in IT with the new name, the IT Center for Educational Programs (ITCEP). The University of Minnesota Talented Youth Mathematics Program

(UMTYMP) is now a part of ITCEP. ITCEP assists the School with the Master's Degree Program in Mathematics with Emphasis in Mathematics Education and with the development and administration of undergraduate programs.

CONTACTING US

Mathematics Department:

Narash C. Jain, Department Head
School of Mathematics
University of Minnesota
127 Vincent Hall
206 Church Street S.E.
Minneapolis, MN 55455
www.math.umn.edu
e-mail: dept@math.umn.edu
telephone: (612) 625-5591
fax: (612) 626-2017

Narash C. Jain (612) 625-5591
jain@math.umn.edu

Graduate Studies:

Don Kahn, Director, (612) 625-1306
kahn@math.umn.edu

Institute for Mathematics and its Applications (IMA)

Willard Miller Jr., Director
Robert Gulliver, Associate Director
Frederic Dulles, Assoc. Program Director

514 Vincent Hall,
206 Church Street S.E.
Minneapolis, MN 55455
gopher: <gopher://gopher.ima.umn.edu>
www.ima.umn.edu
anonymous ftp: <ftp://ftp.ima.umn.edu>
telephone: (612) 624-6066
fax: (612) 626-7370

Minnesota Center for Industrial Mathematics (MCIM)

Avner Friedman, Director
Fadil Santosa, Associate Director
127 Vincent Hall
206 Church Street S.E.
Minneapolis, MN 55455
www.math.umn.edu/mcim
e-mail: tcarr@math.umn.edu
telephone: (612) 625-3377
fax: (612) 624-2333

IT Center for Educational Programs (ITCEP)

Harvey Keynes, Director
115 Vincent Hall
206 Church Street S.E.
Minneapolis, MN 55455
www.math.umn.edu/itcep/
e-mail: itcep@math.umn.edu
telephone: (612) 625-2861
fax: (612) 626-2017

University of Minnesota
School of Mathematics
127 Vincent Hall
206 Church St. S.E.
Minneapolis, MN 55455