

School of Mathematics

Newsletter Volume 15, Spring 2009



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Greetings to all alumni, students, faculty, staff and friends of the School of Mathematics. Last year, as you may recall, Larry Gray was looking forward to the end of his successful five year term as Head. This year, much to my surprise, finds me in his stead, and therefore having to prepare some remarks for the Head's newsletter column. While few faculty aspire to or are prepared for the Headship, it is an essential cog in the School's operations, and so, relying on the support of my family and colleagues, combined with a mixture of dread and anticipation, I agreed to take on this new challenge. I deeply appreciate everyone's patience and understanding as I "learn the ropes".

For those who do not know me as yet, let me say a couple of words of introduction. I come from a very mathematical family. My father, Frank Olver, is a now retired mathematics professor at the University of Maryland, specializing in asymptotics and special functions. Actually retired is not the right word since, as with many Minnesota emeriti, he remains very active in research, currently serving as chief editor of the soon to be released Digital Library of Mathematical Functions (DLMF). My wife, Cheri Shakiban, is professor of mathematics at the University of St. Thomas and also Associate Director for Diversity at the Institute for Mathematics and Its Applications (IMA) here at the University of Minnesota. She served as Department Chair of St. Thomas for 8 years, and her encouragement and unwavering support is the principal reason that I agreed to follow in her footsteps. Our son, Sheehan, just finished his Ph.D. in numerical analysis at Cambridge University in England and is currently a postdoc at Oxford. Our younger daughter, Noreen, is a sophomore math major here at the U of M. (On the other hand, our older daughter Parizad works in finance — but 2 out of 3 isn't bad!) And, to complete the story, as all of you know, this year has witnessed a spectacular financial crisis whose repercussions will be felt everywhere, including the University. The full extent of its impact on the School

remains to be seen, and I am busily trying to come to grips with how we will cope, while striving to maintain the vitality and range of our research, teaching and service activities. Faculty and staff salaries will almost certainly be frozen, but reduction through furloughs appear to be off the table. Hiring of both regular faculty and postdocs was almost completely shut down this year, although the Dean and Provost did permit us to make one offer to an excellent female candidate that was, unfortunately, declined.

In the face of adversity, our faculty and students continue to excel and make significant contributions to a broad range of mathematical research. This year, Yoichiro Mori, a new assistant professor, received the highly prestigious Sloan Fellowship — the only recipient in all of the University of Minnesota. Duane Nykamp was awarded a five year Career grant, which is the National Science Foundation's most prestigious award in support of junior faculty. Both Yoichiro and Duane work in mathematical biology, and it is reassuring to witness the fruits of the department's commitment to establishing a top level research group in this increasingly vital area of mathematics. Our senior math biologist, Hans Othmer, was named a Fellow of the American Physical Society. In the words of Doug Arnold, "This is great: the American Physical Society honoring a mathematician for work in biology — science as it should be." Doug Arnold himself was recently elected a foreign member of the Norwegian Academy of Science and Letters, an honor bestowed on only a handful of world class mathematicians. In May, Arnd Scheel will be awarded the 2009 J. D. Crawford Award by the Society for Industrial and Applied Mathematics (SIAM) for his work in dynamical systems. And speaking of SIAM, this year Doug Arnold began his tenure as President of this large and highly influential international organization.

So far, despite one of the worst job markets ever, 10 of our Ph.D. students have already secured postdoctoral appointments for next year. In particular, Matthew Dobson, a student of Mitch Luskin, was awarded a highly competitive NSF postdoc, which he will use to conduct research in Paris.

In department news, I have initiated a restructuring of our undergraduate office. I was extremely fortunate that my predecessor Larry Gray was willing to return to his former position as Director of Undergraduate Studies, replacing David Frank who was on leave in the fall. To help Larry and Jack Conn in the undergraduate office, I appointed Bryan Mosher as Associate Director of Undergraduate Studies, tapping into his impressive expertise and enthusiasm for teaching, mentoring and outreach. I anticipate further changes soon, but the details must await next year's newsletter.

Dick McGehee is continuing to do an amazing job as Director of Graduate Studies, and our hands-on recruiting has been paying big dividends in attracting many top US students, particularly females, along with a diverse international group of students. Unfortunately, the budget crisis will severely impact the graduate program, and the number of newly admitted graduate students has been reduced from 24 last year to around 8 this year. On the bright side, Dick was able to secure 5 three year fellowships from the Graduate School for incoming students — an all-time record! Speaking of the Graduate School, the University's recent announcement of its closing and the reorganization of its functions means that there are

potentially major changes in the administration of the graduate program looming on the horizon that Dick and I are striving to anticipate.

Another transition was the appointment of Carme Calderer as the new director of the Minnesota Center for Industrial Mathematics (MCIM). Carme takes the reins from Fernando Reitich, who was on leave on family business in Chile this year. Scot Adams is doing a stellar job (and working very hard) as Executive Director of our new Financial Math Masters' Program, which, even in the current economic climate, continues to attract large numbers of students.

Joel Roberts, a faculty member in the Department since 1972 and a highly recognized expert in algebra and algebraic geometry, will retire at the end of this year. A short article about Joel appears below.

In sad news, we were all shocked to hear of the untimely passing of our colleague Naresh Jain, former Department Head, on January 1. A couple of weeks earlier, Naresh had finished teaching his last class, and was looking forward to retirement and being able to spend more time with his family. We were extremely fortunate to have already taped an interview with Naresh in preparation for the "Featured Colleague" article that appears below. Naresh played a major role in helping convince me to accept this position, and I was counting on listening to his sage advice and experience during my time in office. As with everyone in the department, I will sorely miss him. In further sad news, two of our emeritus faculty, Alfred Aeppli and Jim Joichi, also passed away this fall. Obituaries for all 3 of them appear later in the newsletter.

Let me end by again thanking Larry for his steady, stellar leadership of the School over the past five years, as well as his continuing service in the Undergraduate Office. The department is in excellent shape thanks to his and Naresh's wise stewardship, and so, I hope, will be able to easily weather the oncoming financial storms. I will do my best to build on the legacy that they bequeathed to me.

If you have comments, questions, suggestions, or complaints, please don't hesitate to stop by, call, or send me email.

Mathematically yours,
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Changing of the Guard

Department Head

Larry Gray to Peter Olver

Director of Undergraduate Studies

David Frank to Larry Gray

Institute for Mathematics and its Applications (IMA)

Doug Arnold to Fadil Santosa

Minnesota Center for Industrial Math (MCIM)

Fernando Reitich to Maria Carme Calderer

Retirements

Joel Roberts was born in Denver, Colorado, and grew up in the Denver area. He majored in mathematics at M.I.T. and received his Ph.D. in mathematics from Harvard University. After teaching at Purdue University for four years, he joined the University of Minnesota mathematics faculty in 1972. He has been a full professor since 1980.

Prof. Roberts has done research in algebraic geometry and commutative algebra. MathSciNet lists 21 of his papers in algebraic geometry and 4 in commutative algebra. Two of the papers in commutative algebra are the most widely cited in recent times. He has had five Ph.D. students: Lawrence Marx of UC Davis; Rahim Zaare-Nahandi of the University of Tehran, Iran; Celeste Chayabutr, who has worked in the computer industry; Janet Anderson (now deceased) of Hope College, Michigan; and Haile K. Haile of MCTC, Minneapolis. Joel has given three different month-long lecture series at the National University of Mexico. The most recent, in 2005, was about higher secant varieties. He visited the University of Bergen, Norway, on several occasions for research collaborations. In recent years he has become interested in the use of computers for calculation with polynomials and also for visualization of algebraic curves and surfaces. This work included participation in the 2005-2006 IMA Special Year on Applications of Algebraic Geometry. Graphic examples of these geometric curves and surfaces can be viewed on his website.

Joel Roberts' teaching has included upper level courses related to his research specialties and a very wide range of lower level courses, not only the usual calculus-related courses, but also various implementations of the mathematics course for elementary education majors. During the 1980's he served as a faculty advisor for undergraduate mathematics majors, and for fifteen years, from 1993 through Spring 2008, he was a faculty advisor with the IT Lower Division Program. In recent years he has supervised numerous CLA math major senior projects.

In addition to mathematics, Joel enjoys bicycling, cross-country skiing, hiking, bird watching, and gardening. He and his wife, Gail Roberts, have three sons: Laurence, of San Francisco, CA; Evan, of Birmingham, AL; and Keith, of St. Paul, MN. Ever since his graduate student days, during the Civil Rights Movement and the Vietnam War era, he has been involved with various peace and justice issues. He has also participated in a number of environmental projects. Through his membership in Macalester-Plymouth United Church, he has been active in various peace and social justice causes both here and in Guatemala. We wish Professor Joel Roberts, a happy retirement.

Welcome to Incoming Faculty and New Postdoctoral Appointees

YOICHIRO MORI

Yoichiro Mori, an Assistant Professor in the School of Mathematics, received his Ph.D. degree in September 2006 from the Courant Institute at NYU, under the supervision of Charles Peskin. Yoichiro's thesis concerned problems of electrophysiology related, for example, to the problem of how the heart organizes and synchronizes its beating. His main research interests are in mathematical modeling of biophysical systems, numerical analysis, applied analysis, and scientific computing. Remarkably, Yoichiro holds not only a Ph.D. but also an M.D., and thus comes to the area of biophysical modeling very well-informed on its practical side.

Before joining our department in the fall of 2008, Yoichiro was a postdoctoral fellow at the University of British Columbia. During that time he won a first Leslie Fox prize from the Institute of Mathematics and its Applications of the U.K. for work concerning convergence of the immersed boundary method. The prize-winning work grew somewhat accidentally out of preparation for a talk on the immersed boundary method he was asked to give while at UBC.

Yoichiro's path to his present career was not a direct one – he actually started out in medicine. In March 2002, he finished the six year program at the University of Tokyo leading to simultaneous bachelors and medical degrees. (This is the top medical program in Japan.) It was in the last two years of his undergraduate studies, while making hospital rounds and observing surgeries, that he decided medicine was not really for him. Still, strong interests in biology, as well as mathematics and physics, remained with him. Around that time he discovered the book *Mathematical Physiology* by James Keener and James Sneyd, which was a big influence. As Yoichiro pondered his non-medical future, he turned to a former teacher, Hiroshi Matano of the University of Tokyo (well known to our department) for advice. With Matano's encouragement, he made plans to attend graduate school. Ultimately Yoichiro entered NYU's Courant Institute in Fall 2002. The connection with Matano continues to the present day – the two are now writing a joint paper.

Yoichiro was recently awarded a Sloan Fellowship.

PANOS STINIS

Panos Stinis received a Diploma in Mechanical and Aeronautical Engineering from the National Technical University of Athens in 1996. He completed his military service in 1998. In 2003 he obtained a PhD degree in Applied Mathematics from Columbia University under the supervision of Professor A. Chorin from UC Berkeley. He continued his postdoctoral work in the Mathematics department of UC Berkeley and in Lawrence Berkeley National Laboratory until 2007. In 2007-2008 he was a postdoctoral fellow at Stanford's Center for Turbulence Research. His primary interest is in scientific computation, especially in the design of deterministic and statistical algorithms to address mathematical issues pertaining to complex systems like turbulence. Secondary areas of interest include filtering, phase transitions and inference on networks.

Featured Colleagues

Naresh Jain

It is with great sadness that the committee must report that Naresh Jain passed away suddenly and unexpectedly on January 1, 2009, not long after giving us the extensive



interview on which this article is based. Please see the report on the memorial service for Naresh on page 9 of this newsletter.

Professor Naresh Jain was born in a poor village in rural India, and began his

education in the village school, which had mud floors and lacked chairs and tables. This school only provided the first four grades. To continue, it was necessary to attend another school six miles away. At this point India was in the process of gaining independence from the colonial rule, and Naresh saw no point in learning English, so he balked at going away to study. His wise father allowed his son to stay at home caring for cows and water buffaloes for a year, but during that time Naresh's natural appetite for learning led him to learn English on his own, reading Stevenson's "Treasure Island" among other books. (This was his third language and his third written script!) The next year Naresh began attendance at the new school, skipping the grade he had missed.

After completing high school he took the statewide board examinations, and received a high ranking which permitted him to attend what was then known as Meerut University. By this time his talent for mathematics and physics had become evident. After Meerut he again took statewide exams, which qualified him for graduate study at Agra University, where he intended to study relativity theory. At Agra he was advised to study statistics instead, to have better job possibilities. At this time India was in a very unsettled state and torn by civil war following the end of the colonial period, and the risks of unemployment were real. Naresh completed a master's degree in statistics at the University of Lucknow, but still had a strong interest in physics. He took up a position at Banaras University, hoping to work with V. V. Narlikar, an eminent mathematician and general relativist who was the head of the mathematics department at Banaras. But fate had destined Naresh for probability theory, because at Banaras he came into contact with M. Rajagopalan, a mathematician who had studied at Yale, and this inspired him to enroll in Stanford University to pursue graduate work in statistics.

Although Naresh must have had confidence in his abilities, his actual preparation in mathematics at the time he entered Stanford was rather uneven, with lots of gaps to be filled. Nevertheless he soon switched from statistics to probability, and began work on a Ph.D. thesis under the direction of the formidable Kai Lai Chung, who told him that if he did not pass the qualifying exams he "did not want to see his face again". Apparently Naresh was impressed by the dedication of some of his teachers at Stanford (including the world-famous probabilist K. Ito, who proved amazingly humble and willing to share his knowledge with the young graduate student). Naresh's own attention to teaching later was often noted by his colleagues. He had six Ph.D. students of his own, including Marco Avellaneda (now at the Courant Institute), and Jin Ma (now at USC Los Angeles), and has 20 mathematical grandchildren. In a rather natural way his interest in the graduate program led him to become Director of Graduate Studies. This led him further into administration, and so he served as Associate Head, and finally served as Head of the School of Mathematics for an extended period. The life of a head of department is never easy and is often controversial, but Naresh was widely appreciated for his administrative skills. He devoted himself wholeheartedly to the job, and was able to maintain the department's resources and make outstanding hires during his term. As Head he also strongly supported the teaching mission of the department, continuing his own long commitment to students and the next generation of mathematicians.

Willard Miller

Willard Miller discovered an interest in mathematics at an early age. His grandparents had a collection of math books in the attic (old college texts of an uncle). When Willard was 11 years old he began to rummage around and started to read them. There were algebra and trigonometry books, up to some calculus books. He was able to teach himself topics beyond what a boy of his age learned in school. This led Willard to undergraduate work in mathematics and physics at the University of Chicago. There the physicists tried to steer him away from math, while the mathematicians did the reverse. This led him in the fall of 1959 to graduate school in Berkeley, where he was able to pursue both.



At Berkeley, Willard took a course on methods of applied mathematics under the late Prof. Bernard Friedman, who Willard recalls as an exceptionally fine teacher who wrote on the blackboard with incredible speed. When Willard turned out to be the best student on the first exam, Friedman called him into his office. Friedman invited Willard to be his student — not recalling that Willard was already his advisee. The opportunity to work with Friedman and be supported by his grant was good fortune for Willard. But in those days, not long after the launch of Sputnik, there was a huge influx of government money into

science; Willard actually had to turn down several other fellowships in order to accept Friedman's offer of support. The main themes of Willard's research – special functions, Lie groups, and separation of variables — began, in some form, at that time.

After finishing work on his doctorate late in 1962 (but not graduating until the end of the academic year) he had a productive spring laying foundations for much of his later work. After receiving his degree in 1963, Willard secured a post-doc position at the Courant Institute in New York City. That was a hotbed of activity. Willard remembers especially the seminar of Jack Schwartz in Lie theory. After a year in New York, Willard was offered a job at Minnesota, but turned it down to stay on for one more year. The offer was renewed, and he ended up coming to Minnesota the following year (1965). Willard's Courant office-mate was Charles McCarthy (our emeritus colleague); through that connection Willard first became interested in Minnesota and vice versa.

One striking feature of Willard's research activity is his long term collaborations. His only sabbatical was a year in Montreal (1973) at what is now known as the Centre de Recherche Mathématique (CRM), where he began to work with Pavel Winternitz. Also at the CRM he met Ernest Kalnins from New Zealand. Kalnins had received his degree in Western Ontario, working in areas that were promoted by the great mathematical physicist Eugene Wigner (Princeton). Willard and Ernie hit it off at once, and their collaboration continues to this day. Ernie has been a frequent visitor to our department, while Willard has often reciprocated by visiting Ernie in New Zealand. The visit to the CRM planted in Willard's mind the idea of an institute with "theme years" which eventually matured into the idea of the IMA.

At a meeting of SIAM (the Society for Industrial and Applied Mathematics), Willard was invited to join the editorial board of their new Journal on Mathematical Analysis (SIMA). The invitation came from the founding editor-in-chief, Frank Olver (the father of Peter Olver). Willard eventually succeeded Frank as the editor-in-chief of the journal.

Willard has a long and distinguished record of service to our department and the University of Minnesota. He served as department head for seven years (1978-1986). During this period, the National Science Foundation (NSF) solicited proposals for a new, national mathematics research institute. Willard, Hans Weinberger and George Sell spearheaded a Minnesota proposal, emphasizing applied mathematics. After a long period, the NSF began to inform rejected applicants of their fate, but no direct news came to Minnesota until at last the NSF scheduled a site visit. The Minnesota proposal was deemed to be so compelling that the NSF decided to fund two institutes starting in 1982: a pure mathematics Institute (MSRI) at Berkeley, and the

Institute for Mathematics and its Applications (IMA) at Minnesota. After some arm-twisting, Hans Weinberger agreed to serve a full term as director, with George as deputy director. After Hans stepped down in 1987 and was replaced by Avner Friedman, Willard became the deputy director, serving until 1994. Later, from 1997 to 2001, he served as the full director of the IMA until Doug Arnold, now president of SIAM, took over. The IMA flourishes at Minnesota to this day, under the current direction of Fadil Santosa, having been recently awarded the largest math grant in the history of the NSF.

Between his stints at the IMA, Willard served as associate dean for finance and planning of the Institute of Technology, and for a brief period, as acting dean. During the 1990's, when the Minnesota Center for Industrial Mathematics was formed, Willard was active in enabling this new center to receive support from the University administration.

Along with Harvey Keynes and Jay Goldman, Willard was a driving force for the very successful UMTYMP program, which was founded during Willard's time as department head.

The breadth of Willard's contributions to the Department's missions of research, service and teaching is outstanding. We wish him the best of luck in retirement, fully expecting him, like his role models Hans Weinberger and Don Aronson, to remain actively engaged in research and departmental activities.

Hans Weinberger

On October 4, 2008, the Institute for Mathematics (IMA) and the Institute of Technology hosted a symposium to honor Hans Weinberger on the occasion of his 80th birthday. The newsletter committee decided that this would be a good time to review the great contributions that Hans has made to our department and mathematics in general.

Hans was born in Vienna, Austria. The story of how he came to study and work in America is of interest, and illustrates how a tragic period of history altered lives and in many cases benefited education in the United States. Hans' father was a medical doctor with a specialty in dentistry. An uncle who was also a medical



doctor had decided that there was no future for a Jewish doctor in Austria at that time, and he had emigrated to the U.S. As the Nazis in Germany began to threaten Austria, as well as Jews in general, it seemed certain that Hitler would soon take over Austria. The uncle in the U.S. wrote that the time had come to start applying for visas. They applied for several, and the ones for the U.S. came in first. The only caveat was that they had to find somebody who would take responsibility for them if the father could not find work. This was arranged with Mrs. Kohn of the

prominent New York Strauss family. In the Fall of 1938 they sailed for America. Upon arriving here, they learned that the American Dental Association wanted his father to start dental school over again. His father was able to become a medical intern and then a resident in a hospital in Philadelphia. This led to a job in Woodland, PA, where his father was the only doctor for a considerable area. He was given a car and a few minutes of instruction on how to drive. Then it was time to make house calls. In the sad days of the depression, his services were sometimes paid for by barter. After a couple of years, they learned that there was an opening for a medical examiner job, for the Pennsylvania railroad, in Altoona. This city was a big railroad town at the eastern edge of the mountains. It was near the famous horseshoe curve, which permitted trains to climb into the mountains. Hans' family moved there at the beginning of the American involvement in the second world war.

Since he lived in Pennsylvania, it was logical that Hans attended Carnegie Tech (now Carnegie-Mellon), staying on to write a thesis under R.J. Duffin (who was also the adviser of the late Raoul Bott). When he finished his Ph.D., Duffin sent Hans to the University of Maryland. Since Maryland was the home of the Center for Applied Mathematics and Fluid Dynamics, as well as personalities like Alexander Weinstein, this was an excellent place to go. Hans was able to collaborate with Larry Payne, who by good luck could attend this symposium for Hans so many years later. Hans remained at Maryland for 10 years, and was then invited - by Stefan Warschewski - to come to Minnesota. He was part of the golden age for partial differential equations here, started by Art Milgram and Paul Rosenbloom (see the article in our 2006 newsletter about this period), and his colleagues included Jim Serrin, Don Aronson, Walter Littman, Eugene Calabi, among others. He just missed having Yamabe as a colleague. Hans made fundamental contributions to the theory of partial differential equations, and also served as department head. He served as the first director of the IMA (1982-1987) and was a major force in its creation (a fact which we have learned from everybody EXCEPT Hans). With the strong support of Willard Miller (the department head), Roger Stahle (the Dean of the Institute of Technology) and many leading industrial scientists, the School of Mathematics was one of two winners of a nationwide competition to win support from the National Science Foundation to host a mathematics institute, and the IMA was born, with Hans at the helm. The current director of the IMA, Fadil Santosa, has said "I am the caretaker of the house that Hans built". Hans remained as director for 5 years, and the IMA has been going strong and growing ever since.

This symposium for Hans' 80th birthday was organized by Roger Lui (one of Hans' students), Willard Miller, and Cheri Shakiban. More than seventy people from all over the United States, Canada, Japan, Korea, and Taiwan participated in the event. The principal speakers for the

symposium were Donald Aronson from the University of Minnesota, Mark Lewis from the University of Alberta, Howard Levine from Iowa State University, and John Osborn (who was also Hans' student and who served as Dean of Computer, Mathematical and Physical sciences at Maryland for many years). They all spoke about Hans' many contributions to different areas of applied mathematics, computations, and differential equations. In the evening, a banquet "hosted by Willard Miller and Cheri Shakiban, and organized by Harry Singh" was held at the Carlson Private Dining Room over at the West Bank. During the banquet, Jim Serrin, Larry Payne, George Sell, and Jianzhong Su spoke about their experience with Hans as a friend, a colleague, and an advisor. Fadil Santosa, the current director of IMA, spoke of IMA's beginnings, and how Hans is an integral part of that history. All told, the birthday events were fitting tributes to a great mathematician.

Full details of the symposium may be found on the web site www.ima.umn.edu/2008-2009/SW10.4.08/.

Minnesota Center for Industrial Mathematics (MCIM)

During the academic year 2008-09, the "Industrial Problems Seminar" series, jointly sponsored by the MCIM and the IMA, has featured a state of the art collection of lectures by speakers from national laboratories, and industrial organizations in the Twin Cities area as well as from other locations in the US. The aim of the lectures is to provide graduate students, postdoctoral fellows and faculty members with an insight on research work carried by mathematicians and scientists working outside academics. Speakers from national laboratories included Caroline Gatti-Bono (Lawrence Livermore) and Richard Lehoucq (Sandia). Tom Burns (Starkey Labs), Belma Dogdas (Merck Research), Unnikrishnan (General Motors), Paul Rejto (Pfizer Global Research and Development), Vanessa Lopez (IBM T.J. Watson Research Center), Yongmin Zhang (Wells Fargo) and Viktoria Averina (Boston Scientific).

Graduate students enrolled in the PhD program on "Industrial and Applied Mathematics" held internship positions during the summer of 2008 in Cargill and Vision-Ease. Students from MCIM are expected to hold internship positions in the coming summer as well, in companies such as Schlumberger-Doll Research.

IT Center for Educational Programs (ITCEP)

The Institute of Technology Center for Educational Programs (ITCEP) remains active in both teaching mathematics and training future instructors. Our “Masters in Mathematics with an emphasis in Mathematics Education” program has proven to be very successful in producing excellent instructors for high schools and community colleges throughout the region. Our professional development network of 100 elementary – and middle-school teachers is also thriving, with academic year events supported by funds from the Park City Math Institute (PCMI). ITCEP’s associate director, Jonathan Rogness, recently received a grant from the Minnesota Office of Higher Education’s Improving Teacher Quality program to continue our summer institute for teachers in grades 4-8 who wish to improve their mathematics knowledge.

About 400 students are enrolled in our flagship program, the University of Minnesota Talented Youth Mathematics Program (UTMYMP). The majority attended classes on the Twin Cities campus, but we are happy to note the reinstatement of UMTYMP Calculus at our Rochester site; the course there is being taught by Rebecca Schmitz, a new ITCEP postdoc who earned her Ph.D. in 2008 from the University of Virginia. Roughly fifty UMTYMP alumni are currently undergraduates at the University of Minnesota. A dozen or more are graduate students here, including four students Ph.D. students in the School of Mathematics.

Our largest enrichment program, Girls Excel in Mathematics (GEM) continued its growth this year. Over 250 girls in grades 4-6 came to the department four times, supported by funds from the Center for Energy and Environment. The Math Association of America supports a summer camp for 80 of the GEM participants each year. ITCEP has another 250 elementary and middle school students enrolled in mathematics enrichment programs and also coordinated the 17th Annual Math & Science Family Fun Fair in September, which drew over 3000 people to Coffman Union.

Symposia

Riviere-Fabes Symposium

The Riviere-Fabes Symposium on Analysis and PDE was held April 11-13, 2008, with a spirited group of over 70 analysts, geometers, and applied mathematicians assembling at Vincent Hall for the program which ran from Friday afternoon through Sunday morning. The main speakers this year were Alberto Bressan (Penn State) and Igor Rodnianski (Princeton)

who each gave two hour-long lectures. Professor Bressan spoke on the analysis of several problems, including



variational problems for differential inclusions (with applications to a fire confinement problem) and impulsive control of Lagrangian systems (with applications to locomotion in fluids). Professor Rodnianski discussed some classical problems and recent breakthroughs in the mathematical theory of general relativity. Other speakers at the symposium, who each gave an hour lecture, were Camillo DeLellis (Zurich), Fengbo Hang (Courant), Philippe Souplet (Paris 13), and Monica Visan (IAS). The conference dinner at Coffman Union was marked not only by good food and conversation, but by our own Bonny Fleming’s capturing a photographic image of Don Kahn - a regular on the nonlens side of cameras at department events who has himself been photographed about as often as Thomas Pynchon. Abstracts of the symposium lectures, and a copy of this rare photograph, can be seen at the symposium web page, http://www.math.umn.edu/conferences/riv_fabes_08/.

Yamabe Symposium

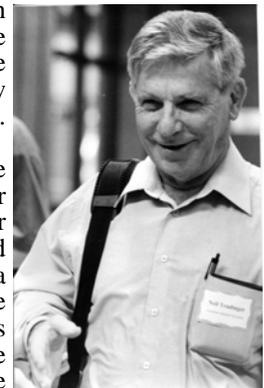
The Fourth Yamabe Memorial Symposium was held in the Mathematics Department of the University of Minnesota Friday-Saturday, September 26-28, 2008. There were eight distinguished mathematicians who came to give talks: Simon Brendle (Stanford University), who spoke on “Ricci flow and the classification of 1/4-pinched manifolds”; Alice Chang (Princeton University), “Topics on conformally compact Einstein metrics”; Gerhard Huisken (Albert Einstein Institute, Germany), “New estimates for mean curvature flow with surgery”; Ngaiming Mok (Hong Kong University), “From the Bergman kernel to holomorphic isometries: a method of analytic continuation”; Leon Simon (Stanford University), “Frequency functions and singular set bounds



Leon Simon

for branched minimal immersions”; Yum-Tong Siu (Harvard University), “Techniques of multiplier ideal sheaves and their applications to algebraic geometry”; Neil Trudinger (Australian National University), “On the higher order Yamabe problem”; and Burkhard Wilking (University of Muenster), “Ricci flow in high dimensions.” Many of the talks were of an unforgettable quality, and some included ground-breaking new mathematical ideas.

The participants included graduate students, postdocs and senior researchers: 27 traveled from other locations across the U.S., Asia and Europe, while 20 from Minnesota enjoyed participating. All of the speakers and 17 additional participants had their expenses paid by the Yamabe Memorial Fund and a grant from the National Science Foundation. The organizers were Bob Gulliver, Tian-Jun Li, and Jiaping Wang of the math department faculty.



Neil Trudinger

For more details, including the history of the Yamabe lectures and Symposia, and a fun collection of photographs, see <http://www.math.umn.edu/yamabe/>.

Master of Financial Mathematics (MFM)



First MFM Class Held at the University of Minnesota

The Master of Financial Mathematics program continues to develop in spite of challenging economic times. Admissions were significantly up last year, and the acceptance rate (number of applicants offered admission over number of complete applications) went down, owing to a decision to improve admissions standards.

The MFM deadline for early response is 28 February, so, for this year, the admissions decisions are just beginning as this is written (2 March 2009). The number of complete applications this year is about the same as last year (107 this year vs. 115 last year on this date), and we are hoping to admit at about the same rate, with an incoming class about the same size. If this happens, the number of students in the MFM program will likely increase to over 100, though that number depends, of course, on our graduation rate, which is as yet unclear.

Last year was MFM's first year of operation and, while some 13 students completed degree requirements, only two of them decided to graduate at the end of the academic year. Both returned to China (one to Hong Kong working for JP Morgan, one to Qingdao working as a proprietary trader). The other 11 continued their education, taking additional optional coursework. Since the summer, two more have graduated, and we expect several more to graduate at the end of this academic year. During the summers, we'll continue to try to collect employment information for our alumni, and will post it as we receive permission from them.

The biggest challenge right now, is, of course, not in input and throughput, but, rather, on the output side, i.e., finding internships and jobs for our MFM students. Carme Calderer, as director of MCIM, has been taking an active role in this process, along with help from the Institute of Technology Career Center for Science and Engineering. It's still too early to evaluate, but what seems to be typical is that, in recessionary times, jobs are harder to get, but internships (being significantly less expensive) are still available. A few of our students have found employment on their own.

The MFM program is helping the mathematics PhD program by expanding the number of TAs employed from two to five, thereby allowing the department to increase its target PhD admissions from five to eight.

We continue to develop our ability to deliver distance education, but are waiting for approval to offer two of our MFM courses.

Awards and Recognition

Doug Arnold

In addition to being awarded a University of Minnesota McKnight Presidential Professorship in Mathematics and also a Guggenheim Fellowship, Professor Doug Arnold is currently serving a four year term as the President of the Society for



Industrial and Applied Mathematics (SIAM). The SIAM President is elected by the SIAM membership to serve a four-year term: one year as President-Elect, then two as President, and one as Past-President. The President manages the professional and scientific affairs of SIAM in conjunction with the SIAM staff. These include SIAM's publishing activities, conferences, advocacy efforts, educational activities, and prizes. He presides over the SIAM Council, which

is the Society's main policy body, appoints most of SIAM's committees, and serves on many of them. He appoints most of the SIAM prize committees and insures the integrity of the prize selection processes. The President represents SIAM and its membership in a variety of venues and to a variety of other organizations such as the Joint Policy Board for Mathematics, and to other societies around the world. In addition, Doug was elected as a foreign member of the Norwegian Academy of Sciences, joining such luminaries as Lenhart Carleson, Alain Connes and David Mumford as one of a select few in mathematics.

Dennis Hejhal

On December 10, 2008, our colleague Dennis Hejhal was honored by having a workshop on Automorphic Forms, Number Theory, and Computation in Uppsala, Sweden, dedicated to him on the occasion of his 60th birthday. Details on organizers, speakers and program can be found at the web site:

<http://www.math.uu.se/~astrombe/DNA/hejhal60/workshop.html>



Yoichiro Mori

Yoichiro Mori was awarded a Sloan Research Fellowship. These prestigious fellowships support the work of exceptional young researchers across the sciences early in their academic careers. Yoichiro was the only recipient at the University of Minnesota this year. See <http://www.sloan.org/fellowships/page/19> for a complete list.

Duane Nykamp

Duane Nykamp has been awarded a five year Career grant from NSF. The Faculty Early Career Development (CAREER) Program represents "...the National Science Foundation's most

prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations.”

Arnd Scheel

Arnd Scheel has been selected for the 2009 J. D. Crawford Award by the SIAM Activity Group on Dynamical Systems. The prize is awarded biennially to one individual for recent outstanding work on a topic in dynamical systems and nonlinear science. The citation for Arnd reads: “For his transformative work on planar defects, on structures generated by inhomogeneities in oscillatory media, and on stability for almost planar fronts and viscous shocks, and for explaining intriguing experimental results and discovering new patterns in the process.” Arnd’s prize will be awarded at the SIAM Conference on Applications of Dynamical Systems at Snowbird, UT, May 17-21, 2009.

George Sell



On September 24-28, 2008, our colleague George Sell was honored by having an International Conference on Infinite Dimensional Dynamical Systems at York University, Toronto, Canada, dedicated to him on the occasion of his 70th birthday. Details on organizers, speakers and program can be found at the web site:

<http://www.fields.utoronto.ca/programs/scientific/08-09/dynsys/>

Ofer Zeitouni

Professor Ofer Zeitouni was recently named the Editor of the *Annals of Probability*, one of the top research journals in the field of probability. This is a three-year appointment for the period January 2009 through December 2011.

IMA News

It has been a period of transition at the IMA. In July 2008, Fadil Santosa took over as director from Doug Arnold, who served as director from 2001. Doug introduced many improvements and innovations to the IMA. During his tenure, he transformed the IMA into a more transparent organization. In the process, he built a sense of ownership of the IMA among the mathematical sciences community. As a result of his efforts, the IMA has grown in influence and importance. Moreover, Doug successfully secured a 5-year renewal funding in 2005.

With the change in the director, there were also new personnel at the IMA. Markus Keel, professor in the School of Mathematics, is currently the Deputy Director. The Associate Director is Chun Liu, professor in the Department of Mathematics at Penn State. Chehrzad Shakiban, who served for two years as associate director, is now Associate

Director for Diversity, leading the diversity efforts at the IMA. Don Aronson has agreed to stay on as Associate Director for the Postdoctoral Program.

The 2008-2009 Annual Program at the IMA is “Mathematics and Chemistry”. Computational chemistry has reached a stage of development where many chemical properties of both simple and complex systems may now be computed more accurately, more economically, or more speedily than they can be measured. The IMA program brings together mathematical scientists and chemists to further advance this field with the goal of increasing accuracy and practicality of computational methods. The program addresses both new theory and new computational algorithms, as well as development of mathematical techniques will play an important role in both of these areas.

In addition to the activities associated with the Annual Program, the IMA also offers other programs. These include the upcoming Summer Program “Nonlinear Conservation Laws”, July 13-31, 2009, the New and Directions Short Course “Applied Algebraic Topology”, June 25-26, 2009, in addition to a series of stand-alone workshops. For students, the IMA is offering “Mathematical Modeling in Industry Workshop” and “Interdisciplinary REU”.

As part of its outreach to the public, the IMA runs the “Math Matters” public lecture series. Speakers for this year are Ingrid Daubechies (Princeton University), Robert Ghrist (University of Pennsylvania), Michael Trick (Carnegie Mellon University), and Albert Lazslo Barabasi (Northeastern University). It was a particular pleasure to have Michael Trick speak in this series. Michael was a former Postdoctoral Fellow at the IMA. In his very popular talk, Michael discussed the challenges of putting together a professional sports schedule, such as for Major Leagues Baseball. He described how mathematical programming, along with combinatorial optimization, are needed to meet the demands of the teams and the fans.

Much more information is available on the IMA web site <http://www.ima.umn.edu/>. Many of the videos of the public lectures and workshop presentations are available for viewing.

Remembering Former Colleagues

Alfred Aepli

It is with sadness that we report the passing of Alfred Aepli in September 2008. Alfred was born in the region of Zurich, Switzerland, and studied at the E.T.H. (Polytechnic) there. He received his doctorate under the direction of Beno Eckmann (who was a student of Heinz Hopf), working in the area of modifications of manifolds. After a short visiting position at Cornell University, he came to



Minnesota where he taught for 37 years. He had several students, of whom the most distinguished is Jim Milgram at Stanford, and collaborated with Larry Markus.

The "McCarthyism of the 1950's" (alas not totally eradicated in eastern Minnesota) and the violent militarism of the 1960's (especially the Vietnam war) left many professors searching for answers outside the ivory towers of academe. Like so many others, Alfred turned to activism, although it is to his credit that he remained positive and avoided all forms of extremism. He was active in the Presbyterian Church on a local and national level, as well as the world federalist movement. He was the author of a successful resolution, on the national level, which called for peaceful resolution of differences between nations, rather than war. He was twice active in (unsuccessful) efforts to create a faculty union. He was also active in the Minnesota Streetcar Association and the Twin Cities Swiss American Association.

Alfred loved music. He was active in music in his church and served for some years on the board of the Music in the Park Series (in his neighborhood: St. Anthony Park). The first concert in that series-Fall 2008-was dedicated to Alfred. He will be missed.

Naresh Jain

Naresh Jain began his education in the Indian state of Uttar Pradesh, and developed an early interest in physics and mathematics. He completed a Master's degree in statistics



in India before moving to the United States with his wife Kusum to enter graduate studies in statistics at Stanford University. He soon switched to the mathematics program and completed a Ph.D. thesis under the direction of Kai Lai Chung. Though offered a position at Stanford after his thesis, Minnesota proved more

attractive, and in the Fall of 1965 he joined a vigorous probability group led by Steven Orey. Naresh found the environment at Minnesota very stimulating and congenial, and he had deep and fruitful collaborations with other members of the department, leading to a long series of influential papers on Markov processes and random walk behavior.

Naresh's dedication to his teaching and his students was a constant throughout his career. As the years went by he made substantial contributions to other areas in probability such as Gaussian processes, diffusions and large deviations, while gradually entering more deeply into the service and administrative side of the department. Kusum and their two children Vivanti and Ajay remained at the center of his

life, and he loved to bring colleagues and visitors to his home for dinner and good conversation. He also developed into an accomplished photographer, fulfilling a passion he shared with several other members of the department. Naresh had many mathematical friends around the world, but the University of Illinois at Urbana-Champaign was perhaps where he felt most at home outside his own department.

Naresh served as Director of Graduate Studies (1986-89), Associate Head (1990-1995) and Head of the School of Mathematics (1995-2003). To all these roles he brought a deep sense of responsibility and a desire to see the department thrive, and through his skill and determination was successful in this goal, making a lasting contribution to the School of Mathematics. He will be greatly missed.

(This article was taken in its entirety from the memorial service held in honor of Naresh Jain.)

Jim Joichi

We are saddened to report the death of our retired colleague Jim Joichi this past October. Jim was born in Colorado in 1927, the youngest of seven sons. Their father was a truck farmer, and so the family moved a lot during the Second World War. At the end of the war, Jim enlisted in the U.S. Army. As a sign of the thinking of that time, the Army recorded his nationality as Japanese — even though he was clearly American by birth.



A superior student with an obvious talent for mathematics, Jim ended up as a graduate student in mathematics at the University of Illinois in Urbana, and wrote his Ph.D. thesis in functional analysis under Prof. Robert Bartle. Jim joined the faculty at the University of Minnesota in 1959, was promoted to full professor in 1989, and retired in 1992. He was an outstanding collaborator, initially working with the late Glen Baxter. He gradually moved towards combinatorics, writing many papers jointly with our colleagues. In particular, collaboration with Jay Goldman and Dennis White led to a series of five influential papers on "rook theory". Jim subsequently collaborated with Dennis Stanton on several elegant papers on partitions. Over the years, Jim played an important role in creating and sustaining a lively and distinguished combinatorics group in our department.

In addition to his research and teaching contributions at Minnesota, Jim served as Director of Undergraduate Studies for four years, where he brought a positive and friendly outlook to what some consider to be a thankless job. For relaxation, Jim enjoyed a variety of hobbies, especially fishing out West. He was never married.

For all of us who knew him, he will be missed.

Undergraduate Program

From the Director of Undergraduate Studies

1. The Carlson School dropped its Actuarial program, so we will start having responsibility for all actuarial students.
2. Bryan Mosher will be the Asst Director of Undergraduate Studies next year. He will be responsible for all matters relating to the quality of teaching, and for undergraduate curriculum issues.
3. It appears that our "College in the Schools" (dual enrollment of Calculus I at 12 high schools, controlled by us) will be taken over by the ITCEP office next year.
4. We expect to be able to handle our teaching load next year, even if there is a cutback in the number of TAs, by hiring extras from other departments, if necessary. Since we won't be paying their tuition, this will help keep us within our reduced budget, as a temporary measure.

2008 Good Teaching Awards

The School of Mathematics congratulates the following students who were recipients of the 2008 Good Teaching Award.

Jeremy C. Bellay, Joao Pedro Boavida, Trevor L. Boehne, Matthew J. Deidrick, Josef G. Dorfmeister, Kristin H. Herreid, Joseph Kenney, Alexander Korolev, Delia D. Letang, Fang Li, Ian S. McCowan, Jonathon Peterson, Jessica P. Striker, Kaisa E. Taipale, Jonathan T. Whitehouse, Esther R. Widiasih, Wenliang Zhang

2009 Barry M. Goldwater Scholars

The School of Mathematics congratulates the following Mathematics Undergraduate sophmores who have been named 2009 Barry M. Goldwater Scholars:

Matthew Coudron, IT Physics and Mathematics
Peter Lofgren, IT Mathematics and Computer Science

Graduate Program

Graduate Student Fellowship Awards

Richard McGehee, Director of Graduate Studies in Mathematics and The Graduate School congratulate the following graduate students who received fellowships.

Matthew D. Dobson, Doctoral Dissertation Fellowship, *Mathematical Foundations of the Quasicontinuum Multiscale Method*, and NSF(National Science Foundation) Mathematical Sciences Postdoctoral Research Fellowship, *Numerical Analysis of Multiscale Hamiltonian ODEs*, Mitchell Luskin, advisor.

Hallie M. Elich, First Year Graduate School Fellowship, Paul Garrett, advisor.

Lu Li, Louise T. Dossdall Fellowship, Vladimir Sverak, advisor.

Francis Valiquette, Doctoral Dissertation Fellowship, *Applications of Moving Frames to Lie Pseudo-Groups*, Peter Olver, advisor.

Ph.D. Graduating Students

Richard McGehee, Director of Graduate Studies in Mathematics and The Graduate School congratulate our recent graduating Ph.D. students (January, 2008 to February, 2009).

Jeremy C. Bellay, *The Stability and Transitions of Coherent Structures on Excitable and Oscillatory Media*, Arnd Scheel, advisor.

Christopher J. Bemis, *Modeling and Optimization of Mortgage Loan Portfolios*, Fasil Santosa, advisor, Whitebox Advisors, LLC.

Kuerak Chung, *Based Cacti*, Alexander A. Voronov, advisor; Research Fellow, Mathematics, KIAS (Korea Institute for Advanced Study), Seoul, Korea.

Ghaith A. Hiary, *Fast Methods to Compute the Riemann Zeta Function*, Andrew Odlyzko, advisor; Postdoctoral Fellow, Pure Mathematics, University of Waterloo, Ontario, Canada.

Alexander Korolev, *Large-Distance Asymptotics of Steady-State Incompressible Fluid Flows*, Vladimir Sverak, advisor, Hausdorff Center for Mathematics, Bonn, Germany.

Harun Kurkcu, *High-Frequency Scattering by Infinite Rough Surfaces*, Fernando L. Reitich, advisor; Sessional Instructor; Postdoctoral Fellow, Department of Mathematics, Simon Fraser University, Burnaby, British Columbia, Canada.

Fang Li, *Stability from the Point of View of Diffusion, Relaxation and Spatial Inhomogeneity*, Wei-Ming Ni, advisor; Research Assistant Professor of Mathematics, Department of Mathematics, Purdue University, West Lafayette, IN.

Jonathon R. Peterson, *Limiting Distributions and Large Deviations for Random Walks in Random Environments*, Ofer Zeitouni, advisor; University of Wisconsin - Madison, Madison, WI.

Brendon Rhoades, *Cyclic Sieving, Promotion, and Representation Theory*, Victor S. Reiner, advisor; NSF Postdoctoral Research Fellow, Department of Mathematics, University of California, Berkeley, CA.

Jessica P. Striker, *Poset and Polytope Perspectives on Alternating Sign Matrices*, Dennis W. Stanton, advisor.

Chuan Xue, *Mathematical Models of Taxis-driven Bacterial Pattern Formation*, Hans G. Othmer, advisor; Postdoctoral Researcher, Mathematical Biosciences Institute, The Ohio State University.

Jiaqi Yang, *Design and Implementation of Accurate and Efficient Integral Equation Methods with Applications to Ultrasound Vibro-Acoustography and Geophysical Propsection*, Fernando L. Reitich, advisor.

Wenliang Zhang, *Lyubeznik Numbers*, Gennady Lyubeznik, advisor; Term Assistant Professor, Department of Mathematics, University of Michigan, Ann Arbor, MI.

Donald Kahn, chair of the Newsletter Committee, would like to thank the committee members and others who helped make this possible, especially the department head, whose presence on our committee is quite unprecedented.

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