

Mathematics



Department of Mathematics

University of Toronto

April 2008

Chair's Report 2007 - 2008



Professor Jeremy Quastel,
Acting Chair

In a number of ways, this has been a transitional year for the Department of Mathematics. John Bland has finished two terms as chair, with only a one year break in between. We are all very grateful for all the work he has done in the last 8 years to build the department. I am serving as pinch hitter chair for the second time in 4 years until Kumar Murty takes over as our new chair in July 2008. We are all looking forward to Kumar's

leadership for the next few years as the department builds on its successes. The dean of Arts and Sciences, Pekka Sinervo, is also stepping down, to pursue his research in experimental high energy physics with the Atlas project. A search is presently on for his replacement and in the meantime, Meric Gertler will serve as acting dean. With all this transition, my job would have been all the more difficult but for the dedicated help of our wonderful staff and faculty. In particular, we are very lucky to have such dedicated young faculty as Robert Jerrard serving as Undergraduate Chair, Robert McCann serving as Associate Chair and Henry Kim as Graduate Coordinator. Remarkably, Henry and Robert are doing this while also serving as chief editors of the Canadian Journal of Mathematics.

This year we welcome our freshman class of Coxeter Assistant Professors, Brian Street, from Princeton, and Frédéric Rochon, from Stony Brook University. We were delighted to hear that Brian just won an NSF postdoc which he will partially use at U of T in the next few years.

Even in an era of very tight resources at the university, the department continues to grow. Presently we have about 60 faculty across the three campuses, about 40 specialists at St George and about 140 students now in our graduate program. The strength of our department in research is high-

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lighted by the large number of external awards. Michael Goldstein is on leave with the highly prestigious Guggenheim and Eckhard Meinrenken has the Steacie. Jim Colliander is the recipient of the McLean Award. Lisa Jeffrey has been elected to the Royal Society of Canada.

Although much of the department is now housed in our impressive new facilities in the Bahen Centre at 40 St George, space continues to be a pressing issue for the department. In particular, the 6th floor of Bahen only accommodates about 2/3 of the department. Some faculty have offices in temporary space in the Earth Sciences building across Huron Street, and the graduate students have had to make do with several spaces scattered across campus. The plan is for us and Statistics to have the top four floors of 215 Huron, connected by a bridge spanning the 3 metres between the 6th floor of Bahen and the 7th floor of 215 Huron. The plan has been a little delayed due to delays in Philosophy's move out of 215 Huron, as well as the change in administration at the faculty level, but is expected to be completed in the next two years. Progress took place last fall when we obtained the 10th floor of 215 Huron, which now houses several faculty and staff, the dynamics lab, and a large proportion of our graduate students, with a very pleasant graduate student lounge and lovely views of the city.

There has been a lot of activity in the department and at the Fields Institute with thematic programs in Operator Algebras in the fall, Harmonic Analysis this winter, and Arithmetic and Hyperbolic Geometry coming up next fall. Yum-Tong Siu of Harvard University will hold the first Faculty of Arts and Science Dean's Distinguished Visiting Professorship associated to next fall's program, and will offer a course on "Transcendental Methods in Algebraic Geometry". Balint Virag has done a great job of organizing exciting Blyth lectures. Last year the Blyth Lecturer was Okounkov, who went on to win the Fields Medal. This year we had three wonderful and accessible lectures on number theory from Manjul Bhargava. As well, this summer the University of Toronto will play host for the first time to the Canadian Undergraduate Mathematics Conference.

We are extremely grateful for all the contributions from our mathematical community which make our department such a great place for teaching, learning and research.

J.Q.

The Changing of the Guard

On 23 July 2007, the Department of Mathematics got the following Memorandum from Professor Meric S. Gertler, the Acting Dean of the Faculty of Arts and Science.

"I am pleased to announce that Professor **Kumar Murty** has agreed to accept the position as *Chair and Graduate*

Chair of the Department of Mathematics for a three-year term beginning 1 July 2008 and ending 2011.

"Professor **Jeremy Quastel** has agreed to serve as *Acting Chair of the Department of Mathematics* from 1 July 2007 to 30 June 2008, while Professor Murty is on research and study leave.

"These appointments have both Provostial and Academic Board approval.

"I would like to thank Professor **John Bland** for his hard work, dedication, loyalty and leadership to the Department and the Faculty of Arts and Science while he served as Chair over the last eight years."

John Bland Honoured



Dean Pekka Sinervo and Professor John Bland

An *Academic Leader Reception* took place on May 30th, 2007, in the Faculty Club of the University of Toronto. The host was Dean **Pekka Sinervo**.

Dean Sinervo took the opportunity to thank Professor **John Bland** for his outstanding contributions to the Department of Mathematics and the Faculty of Arts and Science over the last eight years. These are very much appreciated by us all.

Alumni News

Please send your messages to the Chair at
Chair@math.utoronto.ca

Or at Our Address (since fall of 2005):

The Chair
Department of Mathematics
University of Toronto
Bahen Centre
40 St. George Street, Room 6290
Toronto, Ontario,
Canada M5S 2E4

A GREAT ALUMNUS

J.C. Fields (1863 – 1932)



J.C. Fields

John Charles Fields is best remembered for his zealous endeavours to promote research in mathematics and to obtain funding for it. He conceived the idea of an international award for excellence in mathematical research. He persuaded the International Mathematical Union to hold the International Congress of Mathematicians in Toronto in 1924. The financial support that he was able to obtain for this congress was so successful that there was a surplus, which provided

the main incentive for his idea of an international medal. He canvassed for the medal and found support from various institutions. Ill health prevented him presenting his proposal in person at the Zurich Congress in 1932; he suffered from heart problems. A few days before his death he drew up a will, with J.L. Synge at his bedside, including an amount of \$47,000 to be added to the funds for the medals. He did not live to attend the congress but his plans were still put forward. Adopted at the International Congress of Mathematicians at Zurich in 1932, the first Fields Medals were awarded at the Oslo Congress of 1936.

The full story of how this idea became a reality is explained in Carl Riehm's excellent article on the early history of the Fields Medal in the *Notices of the AMS*, August 2002, Volume 49, Number 7, 778-782.

S.S.

Excerpt from an article by S. Swaminathan in CMS Notes, Volume 38, No. 4, May 2006.

POSTHUMOUS DEGREE

Robert Barrington Leigh (1986 – 2006)

Robert Barrington Leigh who died in August of 2006 at the age of 20 was one of the most outstanding undergraduate students we ever had. When he died, he was in his fourth year, enrolled in the Specialist Programs both in Mathematics and in Physics. Already by his second year he took graduate courses. He won top awards at the University of Toronto and in several international mathematics competitions, both at the University and earlier.

Robert Barrington Leigh has now joined the ranks of our alumni. The University of Toronto awarded him a posthumous degree at the University College convocation last spring. Robert's father, Dr. John Barrington Leigh, attended the convocation to receive the award.

A scholarship fund has been established to honour the memory of Robert Barrington Leigh. Fittingly, the scholarship will be awarded to students in the Departments of Mathematics and Physics, on the basis of academic merit and financial need.

A GREETING CARD FROM ALICE

Catherine Stanley graduated in mathematics from the University of Toronto in 1988 and got her Ph.D. in 1995. She is now teaching mathematics at Acadia University in Wolfville, Nova Scotia. Catherine sent us this remarkable Christmas card, drawn by her 14 year old daughter Alice. Catherine writes:



Drawn by Alice Albarda

“My family and I live in an off-grid home in the Gaspereau Valley, just outside of Wolfville. My husband Hans Albarda is an artist, involved in the

local political and environmental community. Wolfville has been a wonderful town to raise my daughters Alice (14) and Janna (12), a small town blessed with a rich intellectual environment and, like most of Nova Scotia, full of music and art.”

C. S.-A.

ARTS AND SCIENCE SPRING REUNION 2007

Alumni from Mathematics, Physics, and Chemistry gathered on the St. George Campus on June 2, 2007. In the garden between the physics and chemistry buildings was a barbecue, where the participants could exchange news with old friends and also make new acquaintances. There were lectures and guided tours to all departments. **Christie Darville** and **Ingrid Silm** were the organizers. For mathematics, **Ed Barbeau** planned the event, **Robert McCann** gave a talk, and I accompanied the alumni through the new location of our department with its attractive new library and the pleasing festively lit display case of Coxeter's models in the hall.

I demonstrated how to break up a rhombic triacontahedron into 20 rhombohedra, an easy task. To put it back together again was an entirely different story.

The Department of Physics provided a photographer who recorded the reunion. You can enjoy the photos on <http://www2.physics.utoronto.ca/album/SpringReunion2007/>

E.W.E.

Our Undergraduates

THOUGHTS ON TEACHING

Paul Halmos, who died in October 2006, was an excellent, influential, and outspoken mathematician. The AMS published excerpts of his opinions on various subjects in their October 2007 issue of the *Notices of the AMS*, Volume 54.

Halmos's insight on teaching is remarkable. The AMS quotes from the *American Mathematical Monthly* 82 (1975) 466-476:

"The best way to learn is to do; the worst way to teach is to talk. About the latter: did you ever notice that some of the best teachers of the world are the worst lecturers? (I can prove that, but I'd rather not lose quite so many friends.) And, the other way around, did you ever notice that good lecturers are not necessarily good teachers? A good lecture is usually systematic, complete, precise—and dull; it is a bad teaching instrument."

PUTNAM RESULTS 2006

The year 2006 was a banner year for the University of Toronto as our Putnam team achieved its highest ranking in more than a decade.

The team consisting of **Tianyi David Han** in Engineering Science, and **Janos Kramar** and **Viktoriya Krakovna** in the Mathematics Specialist Program placed fourth, winning for the university a prize of \$10,000 and individual awards of \$400.

"I was so proud of being on a team that achieved the highest rank in the last fifteen years," David Han said.

UNIVERSITY OF TORONTO UNDERGRADUATE MATHEMATICS COMPETITION MARCH 2007

The seventh annual Undergraduate Mathematics Competition was written on Sunday, March 11, at the St. George and Mississauga campuses. There were ten candidates.

First place:	Janos Kramar
Second place:	Mu Cai
Third place:	Geoffrey Siu
Honourable mention:	Zhiqiang Li, Samuel Huang, Elena Flat

This is an open competition in which any undergraduate of the University of Toronto may participate.

E.J.B.

AN UNDERGRADUATE MATH CONFERENCE IN CANADA

The 2007 annual Canadian Undergraduate Mathematics Conference (CUMC 2007) was held at Simon Fraser University in Vancouver July 18-21. It was attended by over 80 undergraduates and featured more than 50 talks by students as well as several keynote speakers.

Attending these lectures was a great opportunity to see some new areas of mathematics that we were unfamiliar with, as well as to see some current research being done. They ranged in subject from knots to frequency analysis to the mathematics of juggling. Both of us also presented talks; Katie on Cauchy's functional equation and Iva on the theorem of Erdős, Ko, and Rado. We found it to be a great experience to explain a mathematical idea to fellow math students.

We also prepared a bid to host the 2008 CUMC and were successful. U of T will host the conference next year, bringing students and professors from around the country together in Toronto.

In between all the problem solving, playing "Set" and attending (and giving) talks, the CUMC participants also had the opportunity to explore Vancouver and to get to know other math students in a social setting.

Simon Fraser University was a wonderful host of CUMC 2007 and we are very excited to have CUMC 2008 at the University of Toronto. We'd like to thank the Mathematics Department for all their support.

I.H.
K.M.

2007 DELURY AWARDS (TA)

We are happy to announce that this year's winners of the *Daniel B. DeLury Teaching Awards* for graduate students in mathematics are

Brian Pigott, Jeremy Sylvestre, and Maria Wesslen.

The award is given for outstanding performance as a teaching assistant and significant contribution to undergraduate teaching.

The selection committee consisted of Marie Bachtis, Abe Igelfeld, Mike Lorimer, and Henry Kim.

The selection committee also received many favourable comments about a number of other TAs. Fine work is being done by many of our teaching assistants, and we can take pride in their work.

A small reception honouring this year's three winners was held in May, 2007, in the Math Lounge.

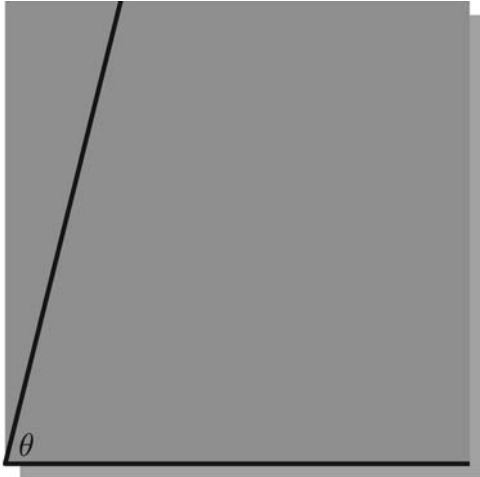
Congratulations to Brian, Jeremy, and Maria!

Famous Problems

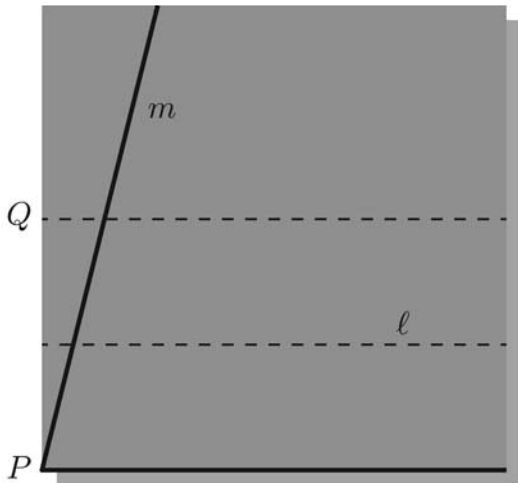
TRISECTING AN ANGLE THE ORIGAMI WAY

Is it possible using only straight-edge and compass to trisect any given angle θ ? This is one of several geometric questions posed by the Greeks of antiquity. It is now well established that straight-edge and compass alone are not sufficient to trisect any angle, but it can be trisected by other means. Origami provides an appealing tool for angle trisection as dem-

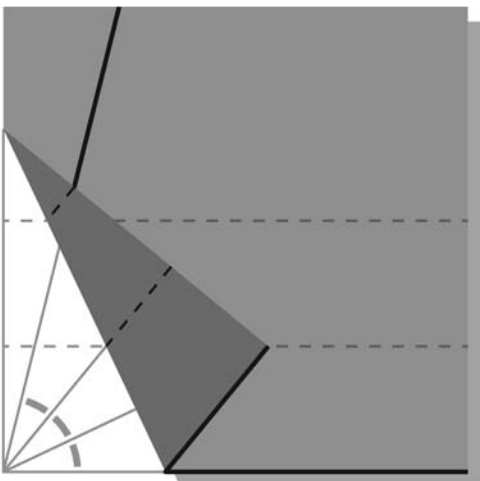
onstrated below (*Notices of the AMS*, Volume 54, Number 5, May 2007, page 628).



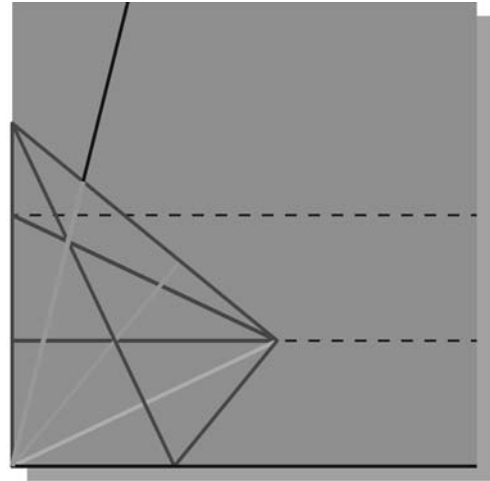
1. Start with an angle θ



2. Construct two uniformly spaced horizontal lines



3. Fold P and Q to l and m



4. The line from the corner to its reflection trisects the angle

THERE IS MORE THAN ONE WAY TO PUBLICIZE THE SOLUTION OF A FAMOUS PROBLEM

Wiles proved *Fermat's Last Theorem*, Perelman provided a proof for the *Poincaré Conjecture*. These two results are generally considered the most outstanding achievements in the last decade. We refrain from trying to explain the mathematics and concentrate on the human aspect surrounding the announcements. Allyn Jackson gives a compelling description in the *Notices of the AMS*, October 2007, Volume 54, Number 9, page 1117.

“One interesting similarity between the two results is that Perelman and Wiles both worked in isolation. Wiles confided in his Princeton colleague Nicholas Katz; it seems likely Perelman confided in no one at all. But the unveiling of their respective results could not have been more different. Wiles revealed his proof before a cheering crowd of his number theory colleagues, who had gathered at the Newton Institute in Cambridge, one of the world’s major mathematics centers. By contrast, Perelman, having become increasingly isolated from the mathematical community, posted his preprints on the arXiv, let a few selected people know they were there, and then waited for the world to respond. Wiles attended the Berlin ICM in 1998 and collected his “special award” from the International Mathematical Union to thunderous applause from the audience gathered at the opening ceremonies. Perelman not only chose to skip the Madrid Congress in 2006, where he was to be awarded the Fields Medal, but he refused to accept the honour altogether.

These two landmark results are very different, but they both show how mathematics proceeds: It starts with a tantalizing question or a flash of insight compelling enough to spark the search for the *why*. This basic human desire for understanding is one reason Wiles and Perelman became heroes to the general public—and to many mathematicians as well.”

A.J.

A VERY INTRIGUING PROBLEM

Terence Tao is a supreme problem-solver whose spectacular work has had an impact across several mathematical areas.

The first highlight is Tao's work with Ben Green, a dramatic new result about the fundamental building blocks of mathematics, the prime numbers. Green and Tao tackled a classical question that was probably first asked a couple of centuries ago: Does the set of prime numbers contain an arithmetic progression of any length? An "arithmetic progression" is a sequence of whole numbers that differs by a fixed amount: 3, 5, 7 is an arithmetic progression of length 3, where the numbers differ by 2; the sequence 109, 219, 329, 439, 549 is an arithmetic progression of length 5, where the numbers differ by 110.

Remarkably, Green and Tao proved that, despite their sparseness, the primes do not contain arithmetic progressions of any length. Any result that sheds new light on properties of prime numbers marks a significant advance. This work shows great originality and insight and provides a solution to a deep, fundamental, and difficult problem.

Terence Tao was one of the recipients of the *Fields Medal* at the *ICM (International Congress of Mathematicians) 2006* in Madrid.

This is an excerpt from a report "2006 Fields Medals Awarded" in the *Notices of the AMS*, Volume 53, Number 9, October 2006, taken from *IMU (International Mathematical Union) news releases*.

Life Embraces Mathematics

KNOTS IN BRAINS

That's Act I of the story. And now, the curtain rises on Act II—fifty years later, almost to the day. It's 10 p.m., and the phone rings in my home. My grandson Yakov Rosen is on the line. Yakov is in his second year of medical school. "Grandpa," he says, "can I pick your brain? We are studying knots. I don't understand the material, and think that our lecturer doesn't understand it either. For example, could you explain to me what, exactly, are 'linking numbers'?" "Why are you studying knots?" I ask; "what do knots have to do with medicine?" "Well," says Yakov, "sometimes the DNA in a cell gets knotted up. Depending on the characteristics of the knot, this may lead to cancer. So, we have to understand knots."

I was completely bowled over. Fifty years later, the "absolutely useless" – the "purest of the pure" – is taught in the second year of medical school, and my grandson is studying it. I invited Yakov to come over, and told him about knots, and linking numbers, and my thesis.

This is an excerpt from an interview, **Sergiu Hart** interviewing **Robert J.Y. Aumann**, "the pure mathematician who

is a renowned economist". The full version has been published in *Macroeconomic Dynamics* 9 (2005), 5, 683-740, and is available at <http://www.ma.huji.ac.il/hart/abs/aumann.html>.

PHISHING

Professor **Stefan Saroiu** of Mathematical and Computational Sciences at U of T Mississauga is leading a new Internet security project that will provide some insight into web phishing.

"Phishing is luring unsuspecting Internet users to a fake website by using authentic looking e-mails in an attempt to steal passwords or gain financial or personal information," Saroiu explained.

Saroiu hopes that this project will ultimately help to develop simpler and more effective web phishing-detection solutions.

Excerpt from an article by **Nicolle Wahl** "UTM Study Tracks Illegal Phishing" in *The Bulletin, University of Toronto*, February 6, 2007, 60th year, Number 12.

KEYFITZ PUBLIC LECTURE MAY 2007

The Nathan and Beatrice Keyfitz Lectures in Mathematics and the Social Sciences is a series of public lectures, made possible by the generous support of Nathan and Beatrice Keyfitz. It will focus on the topic of mathematics and the social sciences and will be held annually.

The **Fields Institute** presented a very informative lecture by **Joel E. Cohen**, Professor of Populations, Rockefeller and Columbia Universities, New York. The title was,

"How Many People Can the Earth Support? And How Do You Know That?"

The topic was well chosen, addressing a concern that is on everybody's mind, and has been, not only now, but all through the ages. Every generation seems to feel that it is particularly urgent at the time; for us this means *now*. Accordingly, Joel Cohen's audience responded enthusiastically; the auditorium was filled with attentive listeners. The lecture was eloquently and elegantly delivered. The topic was well researched. The speaker documented for successive generations the estimates of the number of people that could be sustained on earth. Of course, this number changed at each stage according to the changing world, changes that resulted from developing technical resources. This process will continue; for how long is anybody's guess.

The audience was intensely involved, and at the end some participants offered their concerns and their visions of solutions to global challenges that we face.

Actually, the meaning of the situation described in the lecture could only be fully understood if one had some knowledge of the more technical and experimentally verifiable aspects of population growth. Each period of rapid growth is followed by a period of rapid decline, due to starvation through overpopulation. This process will repeat as long as the environment does not change. The secret of why

the same has not happened to the human population lies in the fact that we have continually made technical advances which change our living conditions.

E.W.E.

Fascinating New Task for Dean Pekka Sinervo

Professor **Pekka Sinervo** will be ending his term as *Dean of the Faculty of Arts and Science* on June 30, 2008. The timing is of particular importance, given that one of Sinervo's long-term research projects, the ATLAS experiment at the Large Hadron Collider in Geneva, Switzerland, is scheduled to begin data-taking in spring 2008.

Dean Pekka Sinervo expresses some of his thoughts on his research in an article in *idea&s**. The article is written jointly with Professor **Amanda Peet**. Its red letter motto

"The search for truth is more precious than its possession" is attributed to Albert Einstein.

We quote excerpts from the article,

"... it will probably be discovered at the world's newest Particle accelerator currently under construction at CERN (the European Organization for Nuclear Research), on the outskirts of Geneva. The Large Hadron Collider (LHC) is a circular proton accelerator that, at nine kilometres in diameter, is the largest scientific instrument in the world. Amazingly, with its enormous array of cutting-edge technology, it will squeeze energy into a space about a million million times smaller than a mosquito. Once it is up and running, discoveries made at the LHC no doubt will be crucial in setting the future direction of physics itself."

"... Moreover, as we scale up or down, at each change in scale, the world seems to behave quite differently. At the molecular level, for example, we encounter quantum effects, which involve uncertainty and introduce probabilities to describe phenomena. When probed at the sub-nuclear level—i.e., at less than 10^{-12} metres—the world looks particularly strange. Indeed, at these smallest imaginable distance scales, we must grapple with the question of the very nature of space and time."

"It is fascinating, therefore, that our attempts to understand nature at the very smallest scales end up compelling us to look at phenomena at the very largest. Thus, to weave our story of the basic structure of matter, forces, space and time, we will draw together threads from the research frontiers in two seemingly disparate fields: particle physics and cosmology. Accordingly, we will consider the largest range of distance scales penetrable by the human imagination."

"... However, it is just as reasonable to ask whether

particle physics should be the same at scales smaller than the current frontier of discovery. Indeed, over the last three and a half decades, an approach which posits that physics is fundamentally different at the shortest scales has taken shape: string theory. The technical details of string theory are highly mathematical and beautifully complex."

A.P.
P.S.

* Excerpts from an article by Amanda Peet and Pekka Sinervo in: *idea&s*, the arts & science review, University of Toronto, autumn 2005, volume 2: number 2, pages 6-9, "Big Questions All Wrapped Up in Small Packages: Beyond Einstein"

There is Music in Mathematics

We are fortunate to have excellent musicians among us. They have repeatedly delighted us in public performances; some of these were part of the popular *Midday Mosaics*, held several times during an academic year at noontime in Hart House.

Catherine Sulem has been a professor in our Mathematics Department for a number of years. On various occasions, we have had the pleasure of hearing her play the violin beautifully. She is both a gifted mathematician and an outstanding violinist. After studying the violin at the *Conservatoire de Nice* and the *Paris National Conservatory*, where she graduated with first prizes in violin and chamber music, Catherine gave many recitals in Europe and Canada, performed concertos with the French National Orchestra and the Israel Sinfonietta with whom she played as principal first violin for five years.

Several times in *Midday Mosaics*, Catherine Sulem was



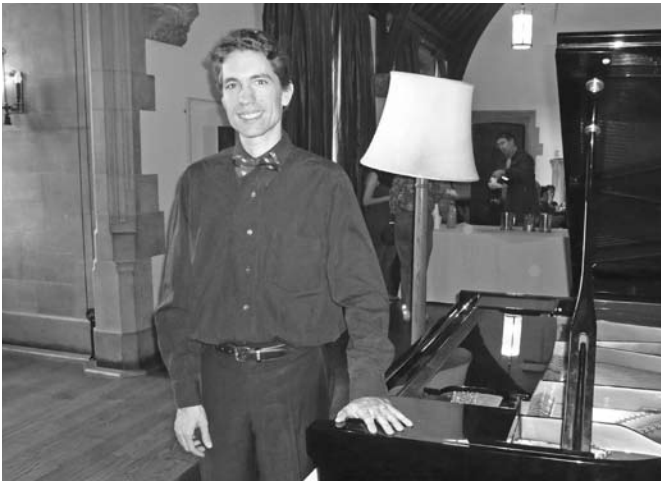
Professor Catherine Sulem



Professors Catherine Sulem and Sydney Bulman-Fleming

accompanied by the pianist **Sydney Bulman-Fleming** who is a professor of mathematics at Wilfrid Laurier University in Waterloo. They gave splendid performances together, such as Beethoven's "Kreutzer" Sonata last spring. In October 2007 they chose to play the lesser known but lovely 3rd Violin Sonata in D minor opus 108 by Johannes Brahms which surprised many in the audience. We still remember an earlier *Midday Mosaics* concert, where they gave a moving presentation of "Thème et Variations" by Messiaen, music of quite a different style, "mon langage musical", as Messiaen himself called it. It is beautiful, indeed!

Now we have another professor in our Mathematics



Professor Valentin Blomer.

Department who is also a genuine musician, in this case a pianist. His name is **Valentin Blomer**. He gave a concert in the *Midday Mosaics* series in October 2007. It was a delight to hear him play pieces by Franz Joseph Haydn, César Franck, Johannes Brahms, and Felix Mendelssohn (Mendelssohn-Bartholdy, as he is known in Germany). Valentin Blomer was born and grew up in Germany. He studied piano at the Faculty of Music in Frankfurt with Professor Seidel and graduated summa cum laude in piano performance. He was a guest artist at major music festivals. He

distinguished himself as a soloist and chamber musician across Europe, in Japan, and in Canada. He made his debut in Toronto in 2004 with the Hart House orchestra performing Beethoven's first piano concerto.

E.W.E.

New People in the Department

This year we welcome two young mathematicians who will be with us for three years.

Frédéric Rochon comes from the State University of New York, Stony Brook. He was appointed as Coxeter Assistant Professor. His areas of interest are differential geometry, index theory, and pseudodifferential operators.

Brian Street who comes from Princeton University was also appointed as Coxeter Assistant Professor. His research field is harmonic analysis.

The Department of Mathematics is also pleased to welcome **Jeanette Atkinson** who joined the department as Assistant to the Chair last August. Jeanette has worked in various departments in the University.

Awards for Faculty

We congratulate our colleagues who got awards for their outstanding performances.

Professor **Lisa Jeffrey** has been elected to the *Royal Society of Canada*. Lisa Jeffrey has made fundamental contributions to symplectic geometry, spaces of moduli, and mathematical physics.

Professor **James Colliander** is the recipient of the 2007 *McLean Award*. The *McLean Endowment* was created in 1995-96 by a gift of \$1 million from Mr. William F McLean, alumnus and benefactor of the University of Toronto. The McLean Endowment is administered by the University's Connaught Committee. The specific purpose of the *McLean Award* is to provide extraordinary support to an outstanding researcher at the University, in the physical, mathematical, or engineering sciences, relatively early in his or her career by assisting the awardee to attract and support graduate students and post-doctoral fellows of great promise as part of his or her research team.

Professor **Michael Goldstein** was awarded a 2007 *Guggenheim Fellowship* for his work on *Anderson localization*. Guggenheim Fellowships are grants that have been awarded annually since 1925 by the *John Simon Guggenheim Memorial Foundation* to those "who have demonstrated exceptional capacity for productive scholarship". The fellowships

Obituaries

are open only to advanced professionals in mid-career. The purpose is to give fellows “blocks of time in which they can work with as much creative freedom as possible, substantially free of their regular duties”.

Professor **Eckhard Meinrenken** received an *NSERC E.W.R. Steacie Memorial Fellowship*. This is one of Canada’s premier science and engineering research awards. These NSERC awards make it easier for Canada’s best and brightest university professors and their students to conduct research that will contribute to our national stock of knowledge, and ultimately to our prosperity.

The award was named after Edgar William Richard Steacie, a physical chemist and President of the National Research Council from 1952 to 1962. He strongly believed that promising scientists are Canada’s greatest asset and should be given every opportunity to develop their own ideas.

Eckhard Meinrenken has been recognized for his mathematical creativity and success in tackling very difficult problems in his research area *symplectic geometry*.

Professor **Luis A. Seco** and his corporate partner **Algorithmics Inc.**, a risk management company, received *NSERC’s Synergy Award for Industrial Collaboration*. Their partnership has yielded financial software that identifies and manages the risks involved in complex financial instruments. Seco and Algorithmics were the first to apply financial engineering—the confluence of math and computer science—to practical challenges within the financial industry.

“This award is seldom given to mathematics and is perhaps a reflection that math is growing in many directions, abstract as well as industrial avenues,” says Luis Seco and continues enthusiastically, referring to “the new golden age for math”. The university leaders in each of these collaborations will receive a \$25,000 NSERC research grant. Industry partners will receive the prestigious *Synergy Sculpture*.

The President of NSERC, Professor Suzanne Fortier, said in her speech honouring these partnerships, “I am especially pleased to note that the winning partnerships have been strong proponents of student training.”

A celebration of the award was held at the Fields Institute in November 2007.

Professor **Jeffrey Rosenthal** is the winner of the *2007 COPSS Presidents’ Award*. COPSS is the *Committee of Presidents of Statistical Societies* which sponsors and presents the COPSS Presidents’ Award annually to a young member of the statistical community in recognition of outstanding contributions to the profession of statistics. The award was established in 1976, and consists of a certificate and cash award. The Presidents’ Award is the most prestigious honour bestowed by COPSS.

E.W.E

Keith Ranger (1935 – 2007)



Professor Keith Ranger

Keith Ranger, a member of the department since 1961, died on February 28, 2007, at the age of 71. He had received both his undergraduate and graduate training at University College, London, writing his thesis with W.R. Dean, who was one of the last of the breed who completed only a bachelor’s degree, but so successfully that a fellowship and permanent position followed.

Keith’s thesis concerned questions on the nature of slow viscous flow, and although his subsequent work, leading to over 120 publications, covered a wide range of topics he continually returned to such questions, and it was in this area where his major contributions lay. In fact, it was his early work in the theory of generalized axisymmetric potential theory, where he was able to develop different integral representations for the solutions appropriate to distinct geometries, that led to the breakthrough for his most important results. Although it had been known from the 1950s that the equations for slow viscous flow did show the possibility of flow separation, no examples had been found and there were strong doubts as to the physical existence of such a phenomenon. But in 1976 Keith did present two distinct situations where such a behaviour was present, utilising these earlier mathematical results; precise solutions were calculated which could show clear streamlines for the resulting flow. This work, plus further extensions, cemented his reputation in the fluid mechanics community—with chemical engineers who had a wider catalogue of flows to boost their intuitive understandings, and with workers in computational fluid dynamics who had exact solutions on which to test their numerical schemes. His election to the Royal Society of Canada in 1979 was based to a large extent on the value of these contributions.

For many years he taught two advanced courses in partial differential equations and asymptotic methods; each year a number of physics and engineering students were explicitly advised by their supervisors to take these courses, and more than one (now distinguished scientist) has been heard to say, effectively, “It was Ranger who taught me all my mathematics.”

In an administrative vein, he was involved right at the beginning in the development of the Canadian Applied and Industrial Mathematics Society, and served on the Editorial Board of the society’s journal from its inception. However, his main involvement was as one of two core members on the organizing committee for the Canadian Symposium of Fluid Dynamics, maintaining a steady hand as organizers came and went. For all this work he received the *Arthur Beaumont Distinguished Service Award* from the society in 2004.

Through all these activities he was a most generous colleague, always ready to give assistance to staff and students alike; all could rely on his encyclopaedic knowledge of his discipline to describe what had been done, or what had been tried in the past—with necessary references. A number of his best papers were co-authored; he had shared his thoughts as they were developing, and when colleagues contributed an idea they would be incorporated into the publication, even as they acknowledged Keith's dominant role.

Outside of his work, music was his major passion; he started to play the violin while still at school, and his daily (or nightly) hour long practice was a fixture throughout his life. In Toronto he joined a local orchestra, and he regularly attended concerts in the city, while at home his research was often to the accompaniment of music from the radio.

Within the department he was ready to be friendly to one and all, prepared to see the best in everyone, and to respond to that aspect of their character, whatever their status. He was respected for what he achieved, for the quiet warmth of his personality, and (as mentioned in a tribute at his memorial) for his deep humanity.

S.H.S.

Israel Halperin (1911 – 2007)



Professor Israel Halperin

I met Professor **Israel Halperin** when I was in first year in the Mathematics, Physics, and Chemistry programme. He was assigned to teach the linear algebra part of our course in algebra. This seemed an odd choice for an analyst, but apparently it was given to him at his particular request. He had the idea that linear algebra could helpfully be viewed as part of the larger theory of operators on Hilbert spaces, a theory that was close to his heart.

So we found ourselves learning about Hilbert spaces and norms and linear operators. In hindsight, there is no denying that everything we needed to know about linear algebra really is contained in the theory of operators on Hilbert spaces, but it certainly seemed that we were being thrown in at the deep end of a very big pool. I'm afraid that some of my classmates floundered, but there were also some who were inspired by this glimpse of a brighter world to come.

Is had an active commitment to fostering young mathematicians, and the tenacity to carry it through. After my third year, he organized a summer project for half a dozen students. We worked away in an inside office in Sidney Smith, happily exploring the mysteries of Hilbert spaces, inspired by discussions with Is and Peter Rosenthal. In my fourth year, Is taught the analysis course, which he ran seminar style. It could be a little overwhelming, but we learned the value of clear mathematical communication along with our functional analysis.

Lunch at the Faculty Club was an important ritual for Is. The Faculty Club was a good deal stuffier in those days, and when Is honoured a group of his students by inviting us to join him, we were dismayed to find that gentlemen were expected to wear jackets, which none of us had. Fortunately, the Faculty Club anticipated the problem and kindly provided them. The one I got fit like a glove (right over my hands), but the occasion was memorable for the way Is made students feel welcome in his world. It was also at the Faculty Club that Is once formed part of a chain of members each of whom put on a pair of rubber overshoes that were slightly too big, except of course for the poor fellow at the end of the chain who was left trying to squeeze his large feet into the remaining tiny overshoes. Before the days of e-mail and cellphones, it took weeks to sort it all out.

In the summer after I graduated, Is and Mary took a group of five students with them to France. Is arranged accommodation and work space at the Université de Grenoble. We immersed ourselves in mathematics and French culture. Mary looked after us all with warmth and generosity. It was a spectacular, life-changing experience for me, a magnificent gift from Is and Mary.

Throughout my years as an undergraduate, I was aware of Is's work on human rights and was occasionally dragooned into helping with envelope stuffing and other chores. As with everything else, he approached it with an astounding clarity of vision and singleness of purpose. At the time, I was only dimly aware of his own political travails, though I now appreciate that there was a powerful personal link. I always admired the strength of his principles. I have asked myself to whom Is might be compared. The short answer is that there could never be another Israel Halperin. However, it seems to me that there are interesting parallels with Winston Churchill. Both of them swam against the stream most of the time, but neither was the least bit bothered by it. They were both blessed with prodigious energy and determination. They both held strong views on a wide range of subjects. Most of all, while each of them was spectacularly wrong on occasion, each of them was often spectacularly right.

J.R.

Our Graduates

GRADS AT MOSAICS

Many mathematicians have a passion for music. Two of our graduate students are gifted musicians and they are also keen to perform for us. **Lucy Liuxuan Zhang** is a soprano and **So Takei** is a pianist. They are pursuing their Ph.D. studies in mathematics and theoretical physics, respectively. Both continue to be involved in music. So Takei accompanies the Hart House Singers and the Hart House Chorus. Lucy Zhang is continuing her vocal training, and sang in

the School of Atelier Ballet's 2007 summer production of Purcell's Fairy Queen.



"The Trio" Professor Catherine Sulem (violin), pianist So Takei, soprano Lucy Liuxuan Zhang;



Soprano Lucy Liuxuan Zhang

At the *Midday Mosaics* concert in Hart House on January 23 this year, we were treated to lovely music performed by Catherine Sulem (violin), So Takei, and Lucy L. Zhang. They played compositions by Mozart, Beethoven, Rossini, and Schubert.

E.W.E.

From the Graduate School

Here are the 2007 *Ph.D. Graduates*, their positions after graduation, if available, and any awards.

Thomas Baird

Field: Symplectic Geometry

Advisors: Lisa Jeffrey and Paul Selick

Thesis Title: The moduli space of flat G -bundles over a nonorientable surface

Currently: NSERC Postdoctoral Fellow, at the Fields Institute for the first half year; the location for the remaining one and a half years of the award will be Oxford

Joseph Callaghan

Field: Several Complex Variables

Advisor: Thomas Bloom

Thesis Title: A Green's function for θ -incomplete polynomials

Kristofer Coward

Field: Operator Algebras

Advisor: George Elliott

Thesis Title: The Cuntz semigroup as a classification functor for C^* -algebras

Currently: Fall of 2007 Postdoctoral Fellow at York University and at the Fields Institute, the Fields affiliation continuing in 2008

Allan Langridge

Field: Number Theory

Advisor: Kumar Murty

Thesis Title: Values of Artin L -functions at $s=1$

Geoffrey Lynch

Field: Algebraic Geometry

Advisors: Edward Bierstone and Caterina Consani

Thesis Title: The local monodromy operator as an algebraic cycle

Currently: Associate Manager, Capital Markets, Bank of Ireland

Gad Naot

Field: Knot Theory

Advisor: Dror Bar-Natan

Thesis Title: The universal sl_2 link homology theory

Currently: Senior Quantitative Analyst, RBC

Gang Zhou

Field: Mathematical physics

Advisor: Michael Sigal

Thesis Title: Asymptotic dynamics of trapped solitons of nonlinear Schrödinger equations with external potentials

Currently: NSERC Postdoctoral Fellow, Princeton University

Awards: Awarded the 2007 *Malcolm Slingsby Robertson Award* for best PhD thesis

We started the Academic Year 2007-08 with 140 registered students. Sixty-one are beginning a new graduate program; thirty-three of these are M.Sc. students, and twenty-eight are Ph.D. students. We also have three visiting graduate students and two exchange students.

I.B.



UNIVERSITY OF TORONTO
DEPARTMENT OF MATHEMATICS

I would like to contribute a total of \$_____ to:

- The Robert Barrington Leigh Scholarship (0560010647)
The Coxeter Undergraduate Scholarship in Mathematics (0560001137)
The Coxeter Graduate Scholarship in Mathematics (0560007048)
The Nicholas Martin Prize in Mathematics (0560007612)
The Adel S. Sedra Undergraduate Scholarship in Mathematics (0560008720)
The Department of Mathematics Trust (0560001562)
This is the Chair's Discretionary Fund which is directed to areas of greatest need—student financial support, visiting lectures, and occasionally conferences.

Graduate Student Endowment Fund

There is currently a remarkable leveraging opportunity that will effectively triple the impact of donations made in support of graduate student awards. Donations of (or totalling) \$50,000 will be matched 1:1 through a special Graduate Student Endowment Fund established at the U of T by the Province of Ontario. The annual payout on the resultant \$100,000 endowment will then be augmented by the University to create a named scholarship of approximately \$6,000 per annum to benefit graduate students, in perpetuity.

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Beginning in ____ (month), 200__

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Donating publicly traded stock and securities is a tax-smart way to support the University of Toronto. You will receive a tax receipt for the full appreciated value of a donation of publicly traded stock or securities, and as of May 2, 2006, you will not be subject to any capital gains tax.

Employee benefit (income) for tax purposes is reduced to zero if the shares acquired through an employee stock option plan of a publicly traded company are donated within 30 days of their acquisition.

