

Mathematics



Department of Mathematics

University of Toronto

March 2007

From the Chair



Professor John Bland, Chair

This has been an exciting year for the Department as we have established our new home and identity in the Bahen Centre for Information Technology. The Department, which occupies the 6th floor, shares the building with the Department of Computer Science and the Department of Electrical and Computer Engineering. Located directly north of the Fields Institute for Research in Mathematical Sciences, our new location

creates a new synergy between the two institutions, as we jointly aim to create one of the foremost centres for mathematical research activity on the continent.

In March, 2006, we hosted the 13th Blyth Lecture, our first in the new building. Andrei Okounkov from Princeton University gave three well-attended lectures on *Limit Shapes, Real and Imagined*. He was awarded a Fields Medal at the meeting of the ICM in Madrid, Spain, last August, for his contributions bridging probability, representation theory, and algebraic geometry. Two members of our Department, Mike Shub and Grisha Mikhalkin each gave an invited forty-five minute address at the same meeting in Madrid.

Graduate expansion has been occupying much of our thinking and time over the past twelve months. The surge in undergraduate enrolment growth, known locally as the double cohort, hit all universities in Ontario in 2002 and now approaches the graduate level. The graduating students are looking for opportunities to further their studies. Our Department has examined our capacity to expand our training for graduate students and determined that we have the supervisory capacity and teaching opportunities to increase our 2004 level of 80 full time students to a new level of 150 full time students by the year 2010. Our only obstacles are space and funding. Since the first wave will be hitting this fall, there is some urgency to accelerate our increase in enrolment. We look forward to participating in this and to raising the stature of the Department to a

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new level within the North American, and indeed global, context.

If you happen to be in the neighbourhood, please drop in and visit our new surroundings. We would be pleased to take you on a tour and show you the location of planned Phase II of our move, when the Department of Statistics and the remainder of our Department come to join us – stay tuned for more details!

It is with great sadness that I mention the passing of some of our friends and colleagues: Nathan S. Mendelsohn (1917-2006) and Irving Kaplansky (1917-2006) passed away last summer. They, together with A. John Coleman, were members of our first Putnam team. They took part in the first ever Putnam competition in 1938 and, in fact, took first Prize. That year, Irving Kaplansky was the first participant ever who was named a Putnam Fellow. Nathan Mendelsohn was Visiting Professor Emeritus at the University of Toronto at the time of his death. His son Eric is a member of the Department. Al Lehman died on May 8, 2006; he had held a joint appointment in the Departments of Mathematics and Computer Science from 1965 until his retirement almost thirty years later. Robert Barrington Leigh passed away in August 2006; he was one of our outstanding undergraduates, well known within the Department and among his classmates for his brilliance and humility, and within the mathematical community for his stellar performances, first at the IMO, and in 2005 as a member of the Putnam team. All of these people will be dearly missed.

J.S.B.

Open House in the New Space



Dean Pekka Sinervo

Many guests were able to admire our splendid new surroundings during our OPEN HOUSE Reception on Monday, October 23, 2006. The Department of Mathematics now lives on the 6th Floor of the Bahen Centre at 40 St. George Street.

The Coxeter models, exhibited in two stylish and lit showcases, are a great attraction. They were prepared beautifully and with great care by Beverley Leslie and her staff. We were pleased to have Donald



Coxeter Models

Coxeter's son and daughter, Mr. Edgar Coxeter and Mrs. Susan Coxeter Thomas, among our guests, ready to admire the new exhibit. Mrs. Susan Stamm was one of the admirers. She is the wife of our former colleague Emil Stamm, now deceased, and an old friend of the Coxeters.

There were short speeches to officially open our new location, to welcome the guests, and to express the pleasure about our new facilities. They were delivered by

John Bland, the Chair of the Mathematics Department,
Pekka Sinervo, the Dean of the Faculty of Arts and Science,
Monica Contreras, Assistant Dean for Planning,
Dexter Roberts, the Moving Co-ordinator,
Jeremy Quastel who guided us through the move during his term as Acting Chair, and Professor in the Departments of Mathematics and Statistics, and
Ed Bierstone from the Space Committee.

Unfortunately, not everyone and not everything connected with our department is located yet in the Bahen Centre. However, progress is being made. Building and renovation is taking place around the university, creating opportunities to relocate the remainder of our colleagues and graduate students. Stay tuned, as we prepare to reunite the rest of the Department of Mathematics and the Department of Statistics in newly renovated adjacent space.

J.S.B.

Alumni News

Many thanks to our alumni who have sent us a number of letters with news, opinions, and ideas. They keep our connection to the "outside world" alive.

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 St., Room 6290
Toronto, Ontario M5S 2E4, Canada

James G. Arthur, University Professor in our department, is also one of our alumni. He was president of the *American Mathematical Society*. His two-year term ended on January 31, 2007. In an interview last fall, given to *AMS Notices* senior writer and deputy editor Allyn Jackson, he talked about the work he did as president. In the process he points out that “the AMS really is a remarkable organization.” He continues, “I should say that I am also proud to be a member of the Canadian mathematical community. The Canadian Mathematical Society (CMS) works closely with the AMS. Canadian mathematics has really blossomed in the last thirty years.”

The full interview appeared in the *Notices of the American Mathematical Society*, Volume 54, Number 2, February 2007, pp. 246-248.

Dr. Zhuang Niu, who received his Ph.D. from our Department of Mathematics a year ago and who was the winner of the *2006 Malcom Slingsby Robertson Prize* for showing excellence in research, is now a Postdoctoral Fellow at the University of Calgary.

Dr. Joseph Sunday received his Ph.D. from our Department of Mathematics in 1973 under the supervision of Professor H.S.M. Coxeter. He is now President of *Creative Affinities Inc.* Donald Coxeter would have been pleased with a business of that name.

Thomas Drucker of the University of Wisconsin-White-water writes to us concerning our article on **Ken May** in our 2006 newsletter:

“... Prof. May is described as having ‘spent most of his career teaching history of mathematics at the University of Toronto’. In fact, he spent more of his career at Carleton College in Northfield, Minnesota, a fact that I verified with the archivist there.”

To put our records straight, Kenneth May was a faculty member in the mathematics department at the University of Toronto for eleven years, from 1966 till 1977. He spent fifteen years at Carleton College in Northfield according to our department records. He died in December 1977, still in the midst of a very active life.

E.W.E.

OUTSTANDING AWARD FOR JUSTIN MOORE

Our alumnus **Justin Moore** won the first prize of \$25,000 in an international mathematics competition which took

place in Vienna, Austria. The Vienna competition was part of the “Horizons of Truth”, celebrating the Gödel Centenary 2006, a four-day symposium in April 2006 attended by mathematicians from around the world. Moore was selected for the ‘Young Scholar’s Competition’ by a panel of international judges after submitting his resumé and a brief summary of his research proposal. Sixty-three applicants, all born in 1970 or later, vied for the ten finalist spots.

Kurt Gödel, a contemporary and friend of Albert Einstein, is famous for his wide-ranging theories that continue to influence issues as diverse as theology, philosophy, cosmology, and artificial intelligence. One of his best-known works, published when he was only 25, deals with the notion that not all truths, even in mathematics, are provable.

Justin Moore is now Assistant Professor in mathematics at Boise State University, Idaho. In fall 2007, Justin will join the faculty at Cornell University. He received his Ph.D. in Mathematics in 2000 from the University of Toronto under the direction of Professor Stevo Todorovic.

Excerpts from an article by Janelle Brown in the *Boise State University News* of May 2006.

E.W.E.

Giving

The Department of Mathematics is very pleased to announce two new scholarships for undergraduates and two new fellowships for graduate students, each the result of significant gifts from alumni and friends.

We are also grateful for a recent anonymous gift of \$20,000 generously directed to the **Coxeter Undergraduate Scholarship in Mathematics** and the **Coxeter Graduate Scholarship in Mathematics at the University of Toronto**.

The **Robert Barrington Leigh Scholarship** has been established to honour the memory of a gifted young man, whose accomplishments in mathematics and physics were truly outstanding, and who touched the lives of so many people at the University of Toronto, where he was undertaking his studies. Fittingly, the scholarship will be awarded to students in the departments of mathematics and physics on the basis of academic merit and financial need. Family, friends, faculty and staff took part in creating this legacy in Robert’s name. It will serve as encouragement for young mathematicians and physicists to excel in their pursuit of their educational goals.

The **Margaret Isobel Elliott Graduate Scholarships in Mathematics**, established in 2005 by the Elliott family, will be awarded to outstanding graduate students in mathematics, with preference given to those specializing in the theory of algebras of operators in Hilbert space or its applications. This remarkable – and only the latest – gesture on the part of Professor Elliott speaks both to his exemplary leadership

within our academic community, and to his unwavering dedication to his vocation and to the students who have come to study with him.

The Estate of Florence Grace Chadburn graciously provided for an undergraduate scholarship to honour her and her husband's commitment to the advancement of education. The **Herbert Edwin Chadburn and Florence Grace Chadburn Memorial Scholarship in Mathematics & Physics** is to be awarded in alternate years to an undergraduate student in the Department of Mathematics and the Department of Physics. Scholarships such as these are helping the best and brightest undergraduate students in the field to achieve their educational goals.

The **Alfred B. Lehman Graduate Scholarship in Mathematics** was established through a generous gift from Al's widow, June Mines. This scholarship will honour the memory of Professor Emeritus Alfred B. Lehman by supporting graduate students working in applied and discrete mathematics. This gift is a fitting tribute to an individual who, as a teacher, mentor, and scholar, was an exceptional citizen of the University of Toronto.

The Elliott and Lehman families both took advantage of the remarkable leveraging opportunity offered through the Graduate Student Endowment Fund established at the U of T by the Province of Ontario. Donations are effectively triple matched to provide substantial named fellowships in perpetuity for the benefit of our graduate students. If you are interested in taking advantage of this program, please contact Christie Darville of Arts and Science Advancement, 416-946-5192, cdarville@artsci.utoronto.ca.

C.D.

Our Undergraduates

OBITUARY

Robert Barrington Leigh (1986 – 2006)

Robert Barrington Leigh died in August 2006. He was a fourth year undergraduate student at Toronto, enrolled in the Specialist Programs both in Mathematics and in Mathematics and Physics. He was an outstanding student, already taking graduate courses by his second year. He won top awards at the University of Toronto and in several international mathematics competitions during that time and the preceding years.

Robert Barrington Leigh was one of the winners of high level mathematics competitions, already when he was still in *Old Scona Academic High School* in his hometown Edmonton.

Professor Andy Liu of the University of Alberta at Edmonton wrote a moving account of the all too short life of a very promising young mathematician.

"I first knew Robert when he was about ten years old. His father brought him to my attention and wanted to enroll him in my Mathematics Club which was intended for junior high school students. ... Robert formally registered for the Club the following year when he was in Grade 6.

"He struck up an instant friendship with Richard Travis Ng who was a year older and lived in St. Albert. Together they worked on a problem from a Hungarian mathematics competition and found an elegant solution which required very little technical background. This led to their first publication, a paper titled *Zigzag* which appeared in the Australian journal *Mathematics Competitions*.

"Two years later, the two teamed up again and wrote a paper titled *Minimizing Aroma Loss*, which was published in the *College Mathematics Journal* in the United States."

Professor Andy Liu lists a dazzling number of prestigious competitions and awards that Robert won all through his school years, starting from Grade 6, in Edmonton, Alberta, and Canada, as well as making the Canadian Team for the International Mathematical Olympiads in Glasgow and Tokyo and the International Physics Olympiad in Taipei, earning a medal on each occasion. Schoolmates in Alberta looked to Robert as a role model.

Robert was the joint author with Andy Liu and three other colleagues of a paper submitted for publication and the joint author with Andy Liu of a book not yet finished. "It is now my painful task to complete it alone," writes Liu. He continues:

"Robert was a soft spoken and mild-mannered young man. Everyone who met him for the first time was always struck by his sweet smile and bashful politeness. ... Robert was kindhearted and always put other people's concerns before his own.

"Robert had good athletic abilities. He had a passion for nature. He was also quite learned in music and art. Robert was a well-rounded person, not just a one-dimensional

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math whiz.

“In Robert’s passing, we have tragically lost a very nice and extremely intelligent young person. There was no doubt, based on his accomplishments so far, that he would have been a prominent mathematician of his time.”

A scholarship fund has been established in memory of Robert by the Departments of Mathematics and Physics. We thank the many friends and his family who have already given to this fund; this is a most fitting tribute to his memory.

From the obituary by A. Liu in the *CMS Notes*, Volume 38, No. 7, November 2006

A.L.
E.W.E.

PUTNAM RESULTS FOR DECEMBER 2005

The *Putnam* contest, a long-established mathematical competition for undergraduate students in North America is well known to our alumni. We are proud that many of our alumni have taken part with great success while they were students themselves.

In December 2005, the University of Toronto team of **Robert Barrington Leigh**, **David Tianyi Han**, and **Jacob Tsimerman** received honourable mention, ranking 6th.

Individually, **Robert Barrington Leigh** ranked between 7th and 16th inclusive, **Roger Mong** ranked between 17th and 24th inclusive. Seven University of Toronto students placed within the top 200.

UNIVERSITY OF TORONTO UNDERGRADUATE MATHEMATICS COMPETITION MARCH 2006

The sixth annual University of Toronto Undergraduate Mathematics Competition was written on Sunday, March 12, 2006. There were seventeen candidates. The top five students and recipients of prizes from the Mathematics Department, ranked in order of merit, are

Jacob Tsimerman
Robert Barrington Leigh
Janos Kramar
Garry Goldstein
Ali Feizmohammadi

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

E.J.B.

BUDAPEST SEMESTERS IN MATHEMATICS

I had the great fortune to participate in BSM, an undergraduate math program in Budapest, Hungary, this fall (2006). The program features small classes taught by enthusiastic

mathematicians from the Renyi Institute and Eötvös University, and there is an emphasis on areas of math of Hungarian specialty: combinatorics, graph theory, and number theory.

The best part of the Hungarian take on math in my opinion is the problem solving. In Budapest, students are given an enormous – some would even say an unmanageable – number of interesting and fun problems to work on, under the assumption that this will *motivate* them to learn the relevant facts for themselves. And motivate it does! I’d never had more fun nor learned more math. Moreover, if a student finds the problems given in graph theory, set theory, topology, and algebra class aren’t enough, BSM offers a course entirely devoted to problem solving. Called “conjecture and proof” (after Erdős’ famous imperative: “conjecture and prove!”), it is the pride of BSM and enough to turn any student into a problem solving machine.

To this – good classes and hard problems – add living and working within a close-knit community of undergrad math enthusiasts, and being in the heart of Europe (I must remark: what a cultural experience! Travel, music, opera, and Hungarian folk-dancing were only a few of the many things I discovered) and the result is an amazing experience. I thank the math department for their support and I hope that future undergrads here will also be able to participate in BSM.

Hold on – I can’t let you go without a couple of problems!

1. Prove: If a rectangle can be tiled by smaller ones, each having at least one side of integer length, then the big one also has a side of integer length. Now find at least three proofs!

2. Does there exist a continuous function defined on $[0,1)$ which takes on each of its values at a finite and even number of points?

K.M.

2006 DELURY AWARDS

We are happy to announce that this years winners of the *Daniel B. DeLury Teaching Awards* are

Steven Dejak, **David Klein**, and **Lindsey Shorser**.

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 Catherine Sulem.

We received also 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.

Interesting Books

By faculty, mathematics:

Peter Rosenthal and his former graduate student **Rubén Martínez-Avendaño** (Ph.D. 2000) wrote a book together,

“*An Introduction to Operators on the Hardy-Hilbert Space*”, volume 237 in the Graduate Texts in Mathematics series, published by Springer-Verlag, copyright 2007 but printed in early December 2006 and currently available from the publisher and many booksellers.

Gustafson, Stephen J.; Sigal, Israel Michael

“*Mathematical Concepts of Quantum Mechanics*”,

Series: Universitext

1st ed. 2003. Enlarged 2nd printing, 2006, Springer.

Stephen Gustafson is a former student of Michael Sigal.

About faculty, related to mathematics:

There is a biography about *H. S. M. (Donald) Coxeter (1907 – 2003)* written by **Siobhan Roberts**,

“*King of Infinite Space: Donald Coxeter, The Man Who Saved Geometry*”, House of Anansi Press Inc., Toronto, 2006.

Two book launches were organized for this book, one in the United States, in Princeton, on the 3rd of November 2006. This was combined with a one-day conference in honor of Donald Coxeter and his work, also honoring John Conway of Princeton University with the donation of a sculpture by Mark Pelletier, a 3D projection of a 4D polytope. One copy of it hangs in the Fields Institute, Toronto.

The second launch took place at the Fields Institute in Toronto on December 13, 2006, in the evening, where Siobhan Roberts talked about her book and showed some short films.

By mathematicians, intriguing applications of mathematics:

Burkard Polster, “*The Mathematics of Juggling*”, Springer-Verlag New York, 2003.

Burkard Polster, “*The Shoelace Book: A Mathematical Guide to the Best (and Worst) Ways to Lace Your Shoes*”, American Mathematical Society 2006.

Book Review

Siobhan Roberts,

King of Infinite Space:

Donald Coxeter, the Man Who Saved Geometry

Writing a biography of a mathematician is an arduous task that should perhaps not even be attempted. Research in general and mathematical research in particular is performed in solitude and isolation. Only the results will be made public, the process remains a mystery. Writing about a scientist has two quite diverse aspects, the person and his achievements.

An unbiased opinion of an individual can perhaps best be formed fifty years after his death. The present work was started while Coxeter was still alive. It is largely based on interviews with Coxeter and with a selected group of people consisting mainly of his admirers. Coxeter died while the book was being written. So it is hardly surprising that the result gives the impression of a eulogy.

The author writes about the mathematician Coxeter and about some objects of his research in a lively and entertaining fashion. She informs, sheds light on Coxeter's life, and offers insight into his personality.

There is a lovely description of Coxeter preparing his departure to a conference in Hungary.

The passages of the book that deal with Coxeter's childhood and student years show an introverted, serious, hard-working, and self-assured young man struggling with obstacles and difficulties at home and at boarding school.

The tale of Coxeter's wooing is frank and moving.

Coxeter was a man who believed that a self-imposed regimen of vegetarian food, push-ups, and other exercises will guarantee longevity, and he was rewarded.

Ms. Roberts reminds us of Coxeter's brand of socializing at parties. He was always ready to pose some trick question such as “What shape is that table?” or “Did you know that an apple has no core?”

Coxeter became enchanted with polyhedra and their counterparts in higher dimensions when he was very young. This fascination accompanied him throughout his life and perhaps even intensified as he grew older. He embraced all of Euclidean geometry. So he had a palpable object as his field of research, a topic that not only has been popular through the ages, its rudiments are even taught in high school. This gave him an opening to disseminate at least some aspects of his studies to the interested public.

Ms. Roberts describes in great detail Coxeter's interaction with non-mathematicians, like the architect Buckminster Fuller and the artist Maurits C. Escher, and she explains how eager Coxeter was to pass on his knowledge to anybody regardless of educational background and how much Coxeter was involved in the shaping of high school curricula. All of that characterizes the “quintessential Coxeter”.

The author of this book on Donald Coxeter describes some objects of his intellectual curiosity, in particular the Platonic solids and their Schläfli symbols, fairly well. Her inclination for and involvement in geometry is remarkable. But, of course one has to keep in mind that she reveals her personal view of these objects to us.

Coxeter was a productive and imaginative mathematician. Clearly he spent most of his time and energy on

research. He was eager to publish his findings. He wrote a number of books and many papers. He gave numerous lectures at various universities and conferences all over the world. He was the most ardent member of the Geometry Seminar at the University of Toronto. He was always in attendance communicating with his fellow geometers when he was in Toronto. All of this gets short shrift in Roberts's book. The clownish photo on the dust cover belies the fact that Coxeter was a serious mathematician.

The claim on page 152, "Introduction to Geometry is encyclopedic in its scope, like the Bourbaki treatise", is not tenable; after all, the first is an undergraduate text.

The animosity between Coxeter and Bourbaki, or Dieudonné as one of its representatives, is only imagined. Coxeter was well recognized by the mathematical community, especially for the seminal work that he did in the 1930s. In his book "A panorama of pure mathematics" (Academic Press 1982) where Dieudonné gives an account of the most influential mathematicians, he mentions Coxeter twice in his sections "The following have also contributed to this theory", first under "Lie groups" and then under "abstract groups".

Geometry is a concept; it can neither perish nor can it be saved.

Changing a few words in the title of the book would in my mind capture more accurately the impression that I got when reading the book. Copy more words of the Shakespeare quote and shorten the subtitle:

"I ... count myself a king of infinite space,"
"Donald Coxeter, the Man."

E.W.E.

Fields Medals

The 2006 Fields medallists were announced at the *International Congress of Mathematicians* held in Madrid, Spain, in August 2006. There were four winners, **Andrei Okounkov** of Princeton University who gave the 13th Blyth Lecture last spring here in Toronto; **Terence Tao** of the University of California at Los Angeles (UCLA); **Wendelin Werner** of the University of Paris-Sud in Orsay, France; and **Grigori Perelman** of the Steklov Institute in St. Petersburg, Russia.

"Grigori Perelman settled the *Poincaré* conjecture which is one of the million dollar Clay problems for this century. Born on 13 June 1966 in Leningrad (now St. Petersburg), Russia, Perelman completed his Ph.D. at the Leningrad State University in the late 1980's. He declined to accept the Fields medal at the ICM in Spain, 2006.

"The Poincaré conjecture is not difficult to explain. It says that a closed 3-manifold which has trivial fundamental group is homeomorphic to the 3-sphere. Poincaré posed this conjecture in 1904 and subsequently it was generalized to higher dimensions. The generalization is that every

compact n -manifold which is homotopy equivalent to the n -sphere is homeomorphic to the n -sphere. For $n > 4$, this was settled by Smale in 1961, for which he received the Fields medal. In 1982, Freedman settled the case $n = 4$ for which he was awarded the 1986 Fields medal. The case $n = 1$ is trivial and the case $n = 2$ is classical and taught to undergraduates in a basic course in algebraic topology. So the case $n = 3$ was the most difficult and Perelman's work represents a culmination of efforts and is a major breakthrough."

Excerpt, "From the Vice-President's Desk" (Professor M. Ram Murty, Queen's University), *CMS Notes*, Volume 38, No. 7, November 2006

Science Magazine rates Perelman's result as the most significant scientific achievement of 2006.

CMS Winter Meeting 2006 in Toronto

The University of Toronto hosted the 2006 Winter Meeting of the CMS (Canadian Mathematical Society) at the Sheraton Centre in Toronto from December 9 to 11. The importance of this conference was affirmed by an impressive line of welcoming speakers:

Thomas S. Salisbury, President of the CMS and Mathematics Professor at York University,

John R.G. Challis, D.Sc., FRSC, Vice-President Research and Associate Provost at the University of Toronto,

Pekka K. Sinervo, FRSC, Dean of the Faculty of Arts and Science at the University of Toronto, and

John Bland, Chair of the Department of Mathematics at the University of Toronto.



CMS President Tom Salisbury



Professors Salisbury and Murty

They had appreciative and encouraging words for the assembled mathematicians, they assured us of their support and their pleasure at having this conference in Toronto.

With over 400 participants and approximately 260 speakers the meeting was a huge success. While most of the members came from Canadian universities, there were also a significant number of colleagues from the USA and from Europe.

The Meeting Director, **Ian Graham**, worked tirelessly for more than a year to organize the 18 scientific sessions of the program. **Erich Ellers** helped with the local arrangements.

The staff of the CMS, in particular its Executive Director, **Graham Wright**, and its Meeting Coordinator, **Gertrud Jeewanjee**, with her group, created a very pleasant atmosphere. The experienced hotel staff guaranteed a smooth progression of events.

Everybody enjoyed meeting old friends and making new connections.

The talks at the meeting were interesting and stimulating. It is remarkable that mathematics, although abstract in nature, is so intimately related to applications, not only in the traditional subjects like physics, but increasingly also in biology and in the fast-developing fields like pattern recognition and, generally, almost all computer related areas.

The *Public Lecture* was given by our colleague **Kumar Murty**, Chair of the Department of Mathematical and Computational Sciences at UTM (University of Toronto at Mississauga). He asked the question, "What is a proof?", and gave as an answer that it means different things to different people. He compared the meaning of 'proof' in several areas, such as philosophy, law, sciences, and mathematics. Not surprisingly, he spent most of the time on mathematics. He also reminded us that GUESSING is an important tool for finding results. A quote from Newton supports this opinion,

"No great discovery was ever made without a bold guess."

In a special ceremony after the **banquet**, the President of the CMS, **Thomas Salisbury**, honoured several outstanding members of the mathematical community.



Professors Graham, Ellers, Wright, Salisbury

The *G. de B. Robinson Award* was given to **Malcolm Harper** of Champlain College, St. Lambert;

the *Adrien-Pouliot Award* to **Peter Taylor** of Queen's University;

the *Doctoral Prize* to **Michael Newman** of the University of Waterloo;

the *Jeffery-Williams Prize* to **Andrew Granville** of the University of Montreal;

the *Distinguished Service Award* to **Richard Kane** of Western University;

the *David Borwein Distinguished Career Award* also to **Richard Kane** of Western;

The CMS expressed their appreciation to **Arthur Sherk** of the University of Toronto for his thirteen years of service as their treasurer. He retired from this position in the summer of 2006. Knowing that Arthur is an ardent golf player, they gave him a set of golf balls.

E.W.E.

Passion, Care, Engagement

When asked about his learning experience with *Israel Halperin*, which he referred to when accepting the Adrien-Pouliot Award, **Peter Taylor** gave this insightful response:

"I had three mentors.

"From *John Coleman* (undergrad) I learned about passion.

From *Israel Halperin* (MSc) I learned about care.

From *Andy Gleason* (PhD) I learned about exposition and engagement.

"In the analysis graduate course in 1965, Israel's text was Dixmier's: '*Les C^* -algèbres et leurs représentations*'. He announced that we would completely understand everything on one page before proceeding to the next. (That's not in fact how learning takes place but it was a significant experience to see what that involved.)

"After 12 weeks we had got to page 20.

"After that I could (and did!) proceed with confidence into the rest of the book."

P.D.T.

TWO TREASURERS OF THE CMS

Professor Emeritus **F. Arthur Sherk** retired in the summer of 2006 from his position as treasurer of the CMS which he held for the last 13 years. He talked about the first treasurer of this organisation at the banquet of the *CMS Winter Meeting* in Toronto, December 2006.

"It is true that I held the office of Treasurer of the CMS for 13 years, but that is by no means a record. The record was established by the first Treasurer of the Canadian Mathematical Congress (as the Society was then called),

W. L. G. (Lloyd) Williams, who was Treasurer for 22 years!"

Arthur Sherk then gave a brief review of Williams's career as a treasurer, quoting from an article entitled *Twenty-one Years of the Canadian Mathematical Congress* by E. S. Keeping (University of Alberta) in 1966 and republished in the book *Canadian Mathematical Society 1945 – 1995*, Vol. 1. He quotes:

"Financial arrangements for the Congress [first meeting of the CMC in Montreal in 1945] were in the capable hands of the Treasurer, Lloyd (W. L. G.) Williams, who secured donations from the National Research Council, the Province of Quebec, and a considerable number of insurance companies and industrial firms, as well as from private individuals. As Max Wyman remarked in his presidential address to the Congress in 1963, 'It is difficult for the younger mathematicians, in these days when money flows like water, to realize how much work was necessary at that time to put the Congress on a sound financial basis.' Ten dollars here, twenty dollars there, it all counted. Shell Oil began by giving \$25 a year; it now contributes \$500. Some of the larger insurance companies now give \$5000 towards Congress, as much as the total cost of the Montreal meeting. The National Research Council, which gave nothing to mathematicians before 1945, contributed \$130,000 in 1965 to the work of Congress, quite apart from the \$350,000 given to university departments of mathematics. These figures are some indication of the changed position of mathematics since the Congress began.

"The soliciting of donations from business and industry continued to be a major activity of Lloyd Williams during the many years of his association with the Congress. By 1964 such support had reached an annual total of \$50,000 to \$60,000, although by that time it represented a steadily declining proportion of the total budget. As, however, government and foundation grants tend to be earmarked for special purposes which have already been proved worthy, it is still vitally important to the activities of the Congress to have money available for new projects." (end of quote)

Arthur Sherk recalls a delightful encounter with Williams:

"My own acquaintance with Lloyd Williams began in August of 1955. It was the custom of the Congress at that time to hold biennial Summer Seminars for a three week period at some location in Canada. In August of '55, the Seminar was in Winnipeg at the University of Manitoba. I was a young graduate student at the time and had been given a grant by the CMC to defray expenses so that I could attend the Seminar. There were perhaps five other student grantees there, as well as a goodly number of mathematicians.

"Lloyd Williams took a personal interest in us, and went out of his way to make sure that we were benefitting socially as well as mathematically by the experience. We frequently dropped into his temporary office in the library of the University of Manitoba and would help out the cause by taking our turn at typing up Proceedings of the Seminar. We felt so much a part of the CMC that by the time that the Seminar

was over, each of us had become a member.

"After I had returned home from the Seminar and had settled all my bills, I found that a small portion of my grant remained. It wasn't much - perhaps \$4.25 - but it wasn't mine and my conscience would not allow me to keep it. So I mailed the balance back to Montreal, along with an explanatory note. A week later, I received a letter from Professor Williams, in which he thanked me very sincerely for the money. He added that he considered it very fortunate for the Society that I had been able to economize so well.

"Like a fool, I have lost the letter!"

F.A.S.

New People in the Department

We welcome our new colleagues:

Professor **Stephen Kudla** comes to us from the University of Maryland and holds a *Tier I Canada Research Chair* in our department. He is an expert in automorphic forms, arithmetic geometry, and theta functions. Stephen has held visiting positions in a number of American and European universities, has supervised a number of Ph.D. students, and served the community in many ways, e.g. as a referee for mathematical journals, as a member of committees, and as an organizer of conferences.

Professor **Vitali Kapovitch** comes to us from the University of Maryland. He received his mathematical education in Russia and in the United States and held several positions as a postdoctoral fellow at Princeton, MSRI Berkeley, the University of Pennsylvania, UC Santa Barbara, and the University of Münster, Germany. Vitali's area of research is differential geometry.

Professor **Omer Angel** is an Assistant Professor in the Department of Mathematical and Computational Sciences at UTM (University of Toronto at Mississauga). His graduate home will be shared between the Statistics and Mathematics Departments. His work is in the area of probability theory and its connections to statistical physics and combinatorics. Omer was educated in Israel and held postdoctoral positions at the Université Paris-Sud and the University of British Columbia.

Professor **Balázs Szegedy** is an Assistant Professor in the Department of Computer and Mathematical Sciences at UTSC (University of Toronto at Scarborough). He received his mathematical education in Hungary, intermittently taking part in exchange programs in Germany. Balázs held a *Young Researcher* position at the Rényi Institute in Budapest and was a postdoctoral researcher at the Microsoft Research

Institute in Redmond, WA. His interests are in group theory, and applications of algebraic methods in combinatorics and computer science.

Also joining us are the following young colleagues:

Dr. **Cheol-Hyun Cho** comes to UTM from Northwestern University. His areas of interest are differential geometry and quantum theory.

Dr. **Kiumars Kaveh** comes from the University of British Columbia. His area of interest is geometric analysis.

Dr. **Raphael Ponge** comes from the Max Planck Institute in Bonn. His interests are in global analysis, analysis on manifolds, and several complex variables and analytic spaces.

We welcome a new member of the administrative staff:

Maryam Ali joined the Department as Assistant to the Chair in September 2006. She comes from the Fields Institute. She took over from Seeta Parker who left us in July 2006 for the Faculty of Health Policy, Management, and Evaluation.

Awards for Faculty

We congratulate the following colleagues who got awards for their outstanding performances.

Professor **Martin Golubitsky**, *Dean's Distinguished Visiting Professor* in our Department, was elected to the *American Academy of Arts and Science* in April 2006.

Professor **Yael Karshon** is the recipient of the *2006 McLean Award*. The award, administered by the Connaught Committee and based on peer review, recognizes outstanding researchers at the University of Toronto early in their careers with a \$100,000 endowment.

Dr. **Anthony Lam** is the recipient of the *2006 Ranjini (Rini) Ghosh Excellence in Teaching Award – Arts and Science Students' Union (ASSU)*. The ASSU will be donating \$500 in the name of Anthony Lam to the Mathematics Department for a new or existing undergraduate scholarship/bursary.

Professor **Jeffrey Rosenthal**, Departments of Statistics and Mathematics, is the *2006 Winner of the CRM-SSC Prize* (jointly sponsored by the Centre de recherches mathématiques and the Statistical Society of Canada). Jeffrey Rosenthal's elegant and landmark results have established him as one of the leaders in the development of Markov chain Monte Carlo methods. Jeffrey is the eighth recipient of this prize.

In addition, we would like to announce that Professors

Robert McCann and **Henry Kim** have agreed to a five year term as Editors-in-Chief of the *Canadian Journal of Mathematics*, appointments that will certainly support the high mathematical quality this journal represents.

Obituary

Alfred B. Lehman (1931-2006)

Professor *Alfred Lehman* of mathematics and computer science died in May 2006 after a long struggle with diabetes.

Lehman received his Ph.D. from the University of Florida in 1954 and worked at several distinguished universities and technical institutes in the United States before joining the University of Toronto faculty as a professor of mathematics and computer science in 1965.

Al Lehman was a remarkable researcher. His areas of expertise were discrete and combinatorial mathematics, specifically network and graph theory, integer optimization, matroids, and lattices. All of these are subjects of major interest to both computer science and mathematics.

In 1991 he received the prestigious *Delbert Ray Fulkerson Prize*, given for outstanding papers in the area of discrete mathematics by the *American Mathematical Society* and the *Mathematical Programming Society*. It was awarded for his paper on width-length inequality and degenerate projective planes, solving in great generality an open problem in combinatorial algorithms that had long resisted solution.

Even after Al ceased teaching and despite his continuing health problems, he regularly attended a broad range of seminars and special lectures in both mathematics and computer science.

At Lehman's memorial service, even some of Al's closest colleagues learned for the first time that Al had been a teacher and mentor to generations of amateur radio operators, enthusiasts who wished to participate and contribute to the valuable services these clubs still provide.

Professor Calvin Gotlieb, a longtime friend and colleague, describes him movingly, the way we all got to know him: "He was a gentle, modest man." We shall miss him.

E.W.E.

From the Graduate School

We started the Academic Year 2006/2007 with 115 graduate students. Forty-six are beginning a new graduate program – twenty-seven of these are M.Sc. students and nineteen

are Ph.D. students. We also have two visiting graduate students.

Here are our 2006 *Ph.D. graduates*, their positions after graduation, and their awards.

CHAN, Jackson

Field: Mathematical Physics, Advisor: Michael Goldstein
Thesis Title: Methods of variations of potential of quasi-periodic Schrödinger equation
Currently: Postdoctoral Fellow, University of Toronto

DEJAK, Steven

Field: Nonlinear PDEs, Advisor: Michael Sigal
Thesis Title: Long-time dynamics of KdV solitary waves over a variable bottom
Currently: Postdoctoral Fellow, University of Toronto

Steven Dejak is one of the three Winners of the Daniel B. DeLury Teaching Award for outstanding performance as a teaching assistant and significant contribution to undergraduate teaching.

DOUGLAS, Andrew

Field: Representation Theory, Advisor: Joe Repka
Thesis Title: A classification of the finite dimensional indecomposable representations of the Euclidean algebra $e(2)$
Currently: Postdoctoral Fellow, University of Saskatchewan

FU, Guangyu

Field: Probability, Advisor: Bálint Virág
Thesis Title: Random Walks and Random Polynomials
Currently: Validation and Quantitative Analyst, CIBC Treasury and Risk Management

HERNANDEZ CORTES, Janko

Field: Mathematical Finance, Advisor: Luis Seco
Thesis Title: Ergodic properties of some hidden Markov models with applications to mathematical finance
Currently: Assistant Professor, Instituto Tecnológico Autónomo de México

HO, Toan Minh

Field: Operator Algebras, Advisor: George Elliott
Thesis Title: On the inductive limits of homogeneous algebras with diagonal morphisms between building blocks
Currently: Postdoctoral Fellow, York University

KNAFO, Emmanuel

Field: Number Theory, Advisor: John Friedlander
Thesis Title: Variance of distribution of almost primes in arithmetic progressions

ROBERT GONZALEZ, Leonel

Field: Operator Algebras, Advisor: George Elliott
Thesis Title: Classification of nonsimple approximate interval C^* -algebras: the triangular case
Currently: NSERC Postdoctoral Fellow, Fields Institute

I.B.



George Elliott, Canada Research Chair holder

Late Notice

Anatol Rapoport (1911-2007)

From *The University of Toronto Bulletin* (20 Feb 07, 60th Year, Number 13) I learned that our colleague Anatol Rapoport died on January 21 this year. He was 95 years old. Anatol joined the University of Toronto in 1970. He was appointed to the departments of psychology and mathematics. He taught mostly statistics and game theory courses at Scarborough College, as UTSC was known then. His eventful, productive, serving and caring life has been described in several 'Anatol Rapoport' websites. Here are my more personal impressions of him.

Anatol was an excellent speaker. From time to time he gave a lecture explaining his game theoretical model of survival and peace to a spellbound large audience. It was easy to assign a tutor to him. He provided the tutor with well worked out solutions of all problem sets he gave to the students.

Anatol and his family were a very welcome addition to the social life of the department that existed at the time. Anatol was hospitable, generous, and friendly. When he heard that my children were learning to play the piano, he sat down at our recently bought piano and to the delight of the children, played some themes from Haydn's Surprise Symphony, clearly surprising everybody. I was no less surprised when I suddenly spotted him during an intermission of a performance at the Opera House in Darmstadt, Germany. He explained that he was in Darmstadt to see the publisher of one of his books.

Long after his retirement in 1979, I encountered him frequently walking slowly from the St. George Subway Station to his office on the downtown campus.

I remember his sincerity and his kindness.

E.W.E.



UNIVERSITY OF TORONTO

DEPARTMENT OF MATHEMATICS

Become a Friend of the Department of Mathematics at the University of Toronto

The Department is hoping to enhance each of the following scholarships in order to greatly increase funds available for student aid, and thus strengthen the Department's ability to attract the very best scholars from across Canada and internationally.

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Are you a grad of U of T? If so, what year? _____

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

- Robert Barrington Leigh Scholarship (0560010647)
- Coxeter Undergraduate Scholarship in Mathematics (0560001137)
- Coxeter Graduate Scholarship in Mathematics (0560007048)
- Nicholas Martin Prize in Mathematics (0560007612)
- Adel S. Sedra Undergraduate Scholarship in Mathematics (0560008720)
- Department of Mathematics Trust (0560001562)

The Chair's discretionary fund is directed to area of greatest need - student financial support, visiting lectures, conferences and other programming.

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 totaling) \$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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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.

Please return this form along with your donation to:

Donations should be made out to the University of Toronto and mailed to:
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For more information, please contact:

Christie Darville
 Senior Development Officer
 (416) 946-5192 or/ cdarville@artsci.utoronto.ca.

