Mathematics

Department of Mathematics   University of Toronto   February 2004

Message From the Chair

Prof. John Bland, Chair

The year 2003 – 2004 is and will be in many ways a watershed year in the life of the University of Toronto. It is the year of the much talked-about 'Double Cohort', in which the Ontario public school system has been officially reduced from 13 grade levels to 12 grade levels, and the universities have accepted entering students graduating from Grade 13 using the old curriculum and those graduating from Grade 12 using the new curriculum. The new curriculum brings with it the additional challenge of adjusting to a new level of background preparation for the entering students.

This year is also the year during which the university embarks upon a new academic planning process entitled 'Stepping up: 2004 – 2010', with its stated vision: "The University of Toronto will be a leader among the world's best public teaching and research universities". With this mission in mind, the department will be reflecting back upon the last two planning exercises and the changes to the department over the past decade, a decade which has witnessed many retirements and during which new faculty were appointed who now constitute over half of the members of the department.

The last few years have been very exciting and successful. It has been a period of significant hiring, with new appointments ranging from extremely promising young mathematicians, to more senior colleagues with well-established international reputations as leaders in their fields. Endowed chairs such as the *Ted Mossman Chair* and government programs such as the *Canada Research Chairs* have played a crucial role in our success. We are convinced that the concentration of excellent researchers will keep the Department of Mathematics among the very best on this continent and, in fact, in the world. The many awards that were received by faculty members confirm the appreciation of their achievements.

Several of our new faculty members are cross-appointed with other departments. This reflects the interdisciplinary nature of their research. They are equally valuable and appreciated in each of their fields. They create a vital link between

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departments and facilitate the flow of ideas between disciplines. The presence of the Fields Institute with its constant flow of top researchers visiting for short and sometimes long periods, coming from anywhere in the world, further stimulates research and helps keep it in vital contact with the forefront of knowledge.

Excellent researchers are excellent teachers. There is a good reason for this. They thoroughly understand what they are doing, they are well informed about the most recent developments in the field, they are indeed the creators of the field, and most importantly, they breed enthusiasm. After all, possibly according to Sappho, "Teaching is not about filling bottles, but about lighting fires!" This wisdom may surely be attributed to everybody's favourite teacher.

Our graduate program is vibrant, and attracts highly talented young students. A great number of them stay for several years and work on Ph.D. theses, an important step into the world of professional mathematicians. Many prestigious awards have been given to our graduate students. We teach a huge, ever growing contingent of undergraduate students on three campuses.

The number of first year students is particularly large this year because these students make up the 'double cohort'. Recognized for their potential, quite a few of our undergraduate students are supported by grants and win competitions. Often they come from a culture of competitions that start in high school.

One of the most serious challenges to the department over the near future will be to obtain and create a new integrated centre for mathematical research and education; indeed, the most trying aspect of the growth of the recent past has come in the form of 'urban sprawl', where graduate students, faculty, and postdoctoral fellows are now spread over six buildings. The creation of a new centre for mathematical research will have a dramatic impact on the research and teaching life of the department, significantly increasing the opportunities for interaction between and among graduate students, postdoctoral fellows, and faculty, reducing the costs for new initiatives, and opening many exciting new possibilities.

It is with great regret that we have to announce the loss of some of our retired colleagues who served the department and the mathematical community for a long time.

On a positive note, we are happy to invite our alumni to take an interest in mathematics, in our department, see the changes in Sidney Smith Hall, see the Fields Institute, admire the sculpture in front of the Fields Institute and step inside, to admire the beautiful staircase and the polytope mobile that is hanging from the ceiling. This wonderful and intriguing mobile was installed in honour of our colleague of over six decades, Professor H. S. M. (Donald) Coxeter. It was inspired by his life-long love for polytopes which was the guiding light to many of his great achievements.

We invite our alumni to attend the Coxeter conference in May 2004. We recommend, in particular, the public lecture or the banquet.

J. S. B.

Sidney Smith Hall 2003

Alumni News

We have collected some news about our alumni, but we would like to have much more. Please, send us anything that you would like to share.

NEWS FROM RECENT PH.D.'S

Rubén Martínez-Avendaño (2000) went to Michigan State University as a Visiting Research Instructor.

Shaloub Razak (2000) will be leaving his job at Bear Stearns in New York to take up a postdoctoral fellowship at McMaster University, starting in January 2004.

David Kerr (2001) held a two-year NSERC Postdoctoral Fellowship in Tokyo and in Rome, and is now a Humboldt Fellow at the University of Münster.

David Saunders (2001) obtained a tenure-track position at the University of Pittsburgh.

Ivan Soprounov (2002) is now a Visiting Assistant Professor at the University of Massachusetts in Amherst.

ALUMNUS HONOURED

The American Mathematical Society (AMS) awarded four *Centennial Fellowships* for 2001 – 2002. One of the recipients was **Ravi Vakil**.

Ravi Vakil got a B.Sc. from the University of Toronto in 1992. He received his Ph.D. in 1997 from Harvard University under the direction of Joe Harris. He was an Instructor at Princeton University (1997 – 1998), a C.L.E. Moore Instructor at the Massachusetts Institute of Technology (1998 – 2001), and is now Assistant Professor at Stanford University. Vakil's research is in the field of algebraic geometry.

Ravi Vakil also won the 4th *G. de B. Robinson Award* from the Canadian Mathematical Society (CMS) for his article "Characteristic numbers of quartic plane curves" in the *Canadian Journal of Mathematics*, Vol. 51, 1999. In this paper, he accomplished the last big step in the solution of a 125 year old problem in algebraic geometry.

FIELDS INSTITUTE FELLOWS 2002

David Brillinger, Berkeley - John Chadam, Pittsburgh - Jerrold Marsden, Caltech - Robert Moody, Alberta - Carl Riehm, McMaster - James Stewart, McMaster

GIFTS TOWARDS SCHOLARSHIPS

Our alumni have shown great interest in the performance of our department. We are grateful for the continuing support we receive from them. Their generosity, understanding, and vision are vital in helping us to attract the most talented students and to give them the means to perform at the highest level of their ability.

Much attention has been given this year to H. S. M. Coxeter's life and achievements — within the mathematical community and also outside. Several newspapers and magazines have published articles about Coxeter and his creative life. In 1995, a special fund named the *Coxeter Scholarship in Mathematics* was established. The scholarship is awarded to undergraduate and graduate students who demonstrate exceptional achievement in mathematics. We welcome contributions towards the *Coxeter Scholarship in Mathematics* for undergraduate and graduate students.

As many people in the mathematical community know, alumnus James Stewart is the author of a highly successful calculus textbook, currently used in MAT 135. He taught both a lecture section and a tutorial in MAT 135 in the 2000 – 2001 academic year. A recent donation by James Stewart will be directed towards the *Coxeter Graduate Scholarship* and will be matched in full by the Provost.

We have received numerous donations towards scholarships in mathematics. Generous gifts have been made to the *George F. D. Duff Graduate Fellowship in Mathematics*, the *Mathematics Alumni Scholarship* for graduate students in the Department of Mathematics, and the *Samuel Beatty Scholarship Fund* for exceptional undergraduate students in mathematics, computer science, or statistics. The latest contributions to the Beatty Fund were given in memory of alumni James A. Boa, John Del Grande, and J. Ray Vanstone.

We are pleased to announce the establishment of the *Ted Mossman / Ontario Graduate Scholarship in Mathematics*. This OGS was liberally endowed by UC alumnus James Mossman in memory of his father.

We are delighted to announce the establishment of the *John R. Levitt / Ontario Graduate Scholarship in Mathematics*. John Levitt, a mathematics and physics alumnus of 1935, generously endowed this scholarship. The first award will be made next fall.

These gifts to the OGS Program attract a 2:1 match from the Ontario Government, creating, in perpetuity, a $15,000 annual scholarship in mathematics.

INTERESTING WEBSITES

www.math.utoronto.ca
    For individual websites, click on 'Faculty'
or: Click on 'Fields Institute',
        then click on 'Information for Visitors',
        then click on 'Tour of the Fields Institute'

or: Click on 'University of Toronto',
        then click on 'St. George Campus (Downtown)',
        then click on 'University College';

you may, of course, prefer to click on your own Campus or College.

E. W. E.

The Double Cohort

THE VICISSITUDES OF THE DOUBLE COHORT OR PUPILS, PARENTS, AND PROFESSORS PONDERING THE PUTATIVE PITFALLS OF THE DOUBLE COHORT

As September 2003 loomed ominously on the horizon, the minds of pupils, parents, and professors were filled with uncertainty and various degrees of trepidation. Two streams of students, the last of the grade thirteen graduates and the first of the grade twelve graduates, were soon to depart high school and home and enter the fabled hallowed halls of higher learning, each armed and trained, somewhat differently, to do battle with the same dragon, first year mathematics.

Pupils and their teachers asked the following questions of university administrators and, most unexpectedly, parents phoned professors directly, with many of the same queries that had been broached in newspapers, radio, and T.V.

(A) Would there be room for the anticipated increased first year enrolment?
Answer: Everything was in place (with fingers crossed). All students requesting a bed on campus were guaranteed a place. The university had even purchased a hotel (!) to accommodate the increased enrolment.

(B) Would academic admission requirements be the same for both streams? This included some abstruse variations like "If my daughter writes both the grade 12 Calculus examination and the grade 13 Calculus examination, will the higher mark be the one considered?"
Answer: Yes. And Yes again.

(C) Did the professors actually know what each stream did and did not know? Indeed, several pupils in the grade 12 stream arrived on U of T day in October 2002 with a list of trigonometric formulae that their teachers said were no longer on the curriculum but were absolutely necessary for university.
Answer: They did. How? By studying the new curriculum obtained from the government, examining detailed course

descriptions obtained from high school teachers, and meeting many times with departmental math heads from local high schools.

(D) How would professors, simultaneously, teach students from the two streams who had quite different academic backgrounds with respect to some material?
Answer: At the beginning of a course, material that one stream did not possess would be taught to all, thus supplying a review to some while presenting new ideas to others. Extra lectures were also added each week to permit more time to present material and allow more time for new ideas to percolate.

Meanwhile the professors and university administrators had a query of their own: Would students, now one year younger, be intellectually, socially, and emotionally mature enough to survive the vicissitudes of first year university? Doubts and anticipated disasters pervaded the hallowed halls like a miasma of menace. Then someone pointed out that students in the rest of Canada — in this case Canada minus Ontario — had been in this situation for the last century and no catastrophic events had occurred either to the east or to the west.

Perhaps all would be well after all. As usual, only the testimony of time would tell the tale.

J. W. L.

THE DOUBLE COHORT AND SUBURBAN CAMPUS RESTRUCTURING

The arrival of the "double cohort", i.e., a graduating class of high school students containing both Grade 12 and Grade 13 students, has proceeded smoothly at the University of Toronto. Of course, some courses have extra lecture sections this year. Total enrolments will increase as the double cohort proceeds through the system, with most of the increase at U of T taking place at the suburban campuses, the University of Toronto at Scarborough and the University of Toronto at Mississauga. Additional construction is taking place, and most suburban campus departments are expected to grow over the next few years. An administrative reorganization has taken place, and the administrative structures on the two suburban campuses resemble each other now more than before. In each case, Mathematics is part of a combined department; at Scarborough it is the Department of Computer and Mathematical Sciences, and at UTM it is the Department of Mathematical and Computational Sciences. The faculty members of a single suburban department belong to various graduate departments of the University of Toronto.

I. G. and J. S.

Our Undergraduates

THE PUTNAM COMPETITION

The University of Toronto team, consisting of Jimmy Chui, Pavel T. Gyrya, and Pompiliu-Manuel Zamfir stood in fifth place in the Putnam Competition written on December 2, 2000. Pavel Gyrya stood among the top 25 students in Canada, bettering his honourable mention of the previous year. David Varodayan achieved honourable mention.

For the following Putnam Competition, written on December 1, 2001, the team of Jimmy Chui, David Varodayan, and Pompiliu-Manuel Zamfir achieved honourable mention, ranking 6th to 10th. Jimmy Chui was the highest ranking student in Canada; Jonathan Sparling achieved honourable mention.

At the Putnam Competition on December 7, 2002, the University of Toronto team, consisting of Jimmy C. Chui, Jonathan Sparling, and Manuel Zamfir again got honourable mention, and two students obtained individual honourable mention, Jimmy Chui and Roger Mong.

THE U OF T UNDERGRADUATE CONTEST

Every March for the past three years, mathematics undergraduates of the University of Toronto have competed in this Competition. We recognize the following winning students:

2001: 1. Jonathan Sparling; 2. Jimmy Chui; 3. Pavel Gyrya; Honourable Mention: Ari Brodsky; Nicholas Martin; Al Momin

2002: 1. Jimmy Chui; 2. David Varodayan; 3. Isaac Li; 4. Fred Dupuis; Robert Ziman; 5. Emily Redelmeier

2003: 1. Jonathan Sparling; 2. David Varodayan; 3. Garry Goldstein; 4. Benjamin Moull; 5. Jimmy Chui; Honourable Mention: Emily Redelmeier; Robert Ziman; Samual Huang

NICHOLAS JOSEPH MARTIN (1982 - 2000)

During the academic year 2000 – 2001, the weekly problems session for undergraduate mathematics students was enlivened by Nicholas Martin, who, despite having to keep an oxygen tank in tow, was an engaging popular figure who demonstrated both zest and skill. From the very beginning of his life, on June 11, 1982, Nicholas was afflicted by a plethora of lung ailments, and at age ten, was one of the pioneers in receiving a double lung transplant. He was a very talented person who showed an early knack with numbers. He was fascinated with baseball to the extent that he was recognized for his little league umpiring in Etobicoke. At U of T, he enrolled in the Mathematics and Computer Science specialist program, he made his mark in competitive chess, and he was recognized in the Dean's list as an outstanding student. Nicholas Joseph Martin was liked and respected by those around him. Students and faculty both admired his generosity, good humour, fortitude, and love of life.

In the summer of 2001, a second lung transplant became necessary, and the complications from this operation took his life on July 13, 2001.

An award has been set up in his honour to recognize the student in the first year mathematics course for specialists (currently MAT 157Y) who most demonstrates excellence and leadership and inspires excellence among classmates.

E. J. B.

The Coxeter Legacy

CONFERENCE INVITATION FOR ALUMNI

The Alumni are cordially invited to attend the Coxeter Conference. We specifically recommend the planned public lecture and the banquet. Please contact the Fields Institute for details.

THE COXETER LEGACY
Reflections and Projections
May 12-16, 2004
University of Toronto

ANNOUNCEMENT

A conference will be held at the University of Toronto in May 2004 in honour of H.S.M. Coxeter.

We intend to reflect on Coxeter's legacy, emphasizing his main achievements, demonstrating the impact of Coxeter's ideas on current research, and exploring future directions.

During the conference there will be talks by invited principal speakers and sessions for contributed talks.

ORGANIZING COMMITTEE
Chandler Davis, Toronto
Erich W. Ellers, Toronto
Branko Grünbaum, Washington
J.W. (Mike) Lorimer, Toronto
Peter McMullen, UC London
F. Arthur Sherk, Toronto
Ravi Vakil, Stanford
Asia Ivić Weiss, York

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Sponsored by
The Fields Institute for Research in Mathematical Sciences
The Canadian Mathematical Society
The University of Toronto

The Two Coxeter Logos

The announcement of our planned conference, *The Coxeter Legacy – Reflections and Projections*, contains two logos which are recognizable as being connected with Coxeter's work.

In the top logo, every string is a *Coxeter diagram* which characterizes a particular *Coxeter group*, where each node represents a reflection. The product of two reflections is a rotation and the connecting lines between nodes indicate the order of the rotation. In the example

$$\sigma_1 \quad \sigma_2 \quad \sigma_3$$

$\sigma_1, \sigma_2, \sigma_3$ are reflections, $\sigma_1\sigma_2, \sigma_1\sigma_3, \sigma_2\sigma_3$ are rotations, and

$$(\sigma_1\sigma_2)^3 = 1, \ (\sigma_1\sigma_3)^2 = 1, \ (\sigma_2\sigma_3)^4 = 1.$$

The second logo is a version of the *Coxeter graph* consisting of 28 vertices, organized in four groups of seven. There are two star 7-gons and a regular 7-gon involved. One of the star 7-gons and the regular 7-gon are clearly visible.

There is no relation between the two logos.

E. W. E.

Writing Mathematics

Mathematicians rely heavily on symbols to communicate their ideas. While some of the symbols can be found on the keyboard of a computer, most of them are missing. Various ways have been invented to include more and ideally all mathematical symbols. In one system, the symbols are stored in templates and then copied into the manuscript, all of course on the computer. While this system may be satisfactory for manuscripts that contain only relatively few formulas, as is often the case in publications in biology or even physics, mathematicians have developed a more efficient and versatile system. It was invented by Donald E. Knuth of Stanford University and is called T_EX; an often used variant is L^AT_EX.

We give a few examples of familiar formulas and we show how they can be expressed using only symbols that are readily available on any keyboard.

Here are a few examples. For each of them, the first formula shows what you want to print, and the second one shows what you type.

$$a^2 + b^2 = c^2 \qquad \$a\text{\textasciicircum}2 + b\text{\textasciicircum}2 = c\text{\textasciicircum}2\$$$

$$\int \sin x\, dx = -\cos x + const$$
$$\$\$\text{\textbackslash}int\text{\textbackslash}sin x\text{\textbackslash},dx = -\text{\textbackslash}cos x + const\$\$$$

α	Γ	$\sqrt 2$	∂
\$\alpha\$	\$\Gamma\$	\$\sqrt 2\$	\$\partial\$

E. W. E.

New People In the Department

We are happy to welcome the new members of our department who joined us during the years 2000 – 2003.

THE ACADEMIC YEAR 2000 - 2001

We introduced Professors Robert Almgren and Katia Consani in our last Newsletter of July 2000. Also joining us that year were Professors Michael Goldstein, Mikhail Kapranov, and Michael Yampolsky.

Professor **Michael Goldstein** accepted a position at our Scarborough Campus in Applied Mathematics and Analysis. Michael is a Full Professor, carrying out research in the spectral theory of Schrödinger operators and localization.

He received his education from Tashkent State University in the former USSR. There he also spent the first thirteen years of his university career. After several years at the University of Beer-Sheva in Israel, Professor Goldstein came to North America in 1998, where he alternated between the Institute for Advanced Study in Princeton and the University of Toronto until the year 2000, when he joined us in a permanent position. He has given invited lectures on his research in Europe, Israel, and the United States. He has supervised a number of graduate students.

Professor **Mikhail Kapranov** came to Toronto from Northwestern University. He is the first holder of the *Ted Mossman Chair in Mathematics* which was endowed in 1996 by James Mossman in memory of his father. It is intended to provide the means for an outstanding mathematician to devote much of his time to intense research. Mikhail Kapranov's research interests include algebra, algebraic geometry, and category theory. He received his education in Moscow and came to North America in 1990. Here he was Postdoctoral Research Associate for a year at Cornell University and then served as a mathematics professor at Northwestern University. Among other distinguished invited lectures he gave a 45-minute talk at the International Congress of Mathematicians (ICM) in Berlin, August 1998, entitled 'Operads in algebraic geometry'.

Professor **Michael Yampolsky** has been a member of the Department of Mathematics since July 2000. His position is in Applied Mathematics and Analysis at our Mississauga Campus. Prior to coming to Toronto he was a Visiting Member at the Institut des Hautes Études Scientifiques, and before that, J.W. Gibbs Instructor at Yale University. His undergraduate education was in Kharkov in the Ukraine. In 1997 he received his Ph.D. from SUNY at Stony Brook under the supervision of Mikhail Lyubich. Michael is a recipient of the Premier's Research Excellence Award (PREA). His main research interest is dynamical systems.

THE ACADEMIC YEAR 2001 - 2002

Professor **James E. Colliander** joined our department in August 2001. He got his Ph.D. in 1997 from the University of Illinois at Urbana-Champaign. He was a Postdoctoral Research Fellow at MSRI, Berkeley, a Visiting Scholar at the University of Chicago, and had positions at the Université de Cergy-Pointoise and at UC Berkeley. He has worked outside the university as a Research Physicist and a Satellite Control Room Manager. His research interests lie in the areas of partial differential equations and harmonic analysis.

In recognition of his accomplishments, Jim Colliander has received several prestigious awards. The most recent one is an Alfred P. Sloan Research Fellowship (2003 – 2005) which will allow him to continue his research at the Institute for Advanced Study in Princeton during the fall of 2003 and at the Fields Institute in the spring of 2004.

Professor **George A. Elliott** has now joined our department as a regular faculty member. For many years, he was an adjunct professor, with a position at the University of Copenhagen, Denmark. He is the first holder of a *Canada Research Chair* in the department. His research interests include the theory of operator algebras, *K*-theory, and noncommutative geometry.

Professor **Henry H. Kim** joined our department as Associate Professor in July 2001 and was promoted to the rank of Full Professor effective July 1, 2003. He came to us from Southern Illinois University where he spent a number of years, interrupted by one year as a Member of the Institute for Advanced Study. Henry Kim received his Ph.D. from the University of Chicago in 1992, and then spent two years in a research position at Purdue University and a year as Postdoctoral Fellow at UC Berkeley. In the United States, his research was supported by the National Science Foundation and the National Security Agency.

Henry Kim works in the Langlands program, an ambitious plan to unify number theory, harmonic analysis, and geometry. This has opened a new frontier in mathematics, providing new insights and techniques to solve old problems, including Fermat's Last Theorem which was finally proved by Andrew Wiles. With his collaborators, Henry Kim has made recent breakthroughs that have opened the door to exciting new developments in automorphic functions, analytic number theory, and representation theory.

Professor Kim is the recipient of an American Mathematical Society Centennial Fellowship. He plans to use this fellowship to visit Purdue University and Yale University.

In 2001, Professor **Adrian I. Nachman** accepted a joint appointment as Full Professor at the University of Toronto in the Department of Mathematics and the Department of Electrical and Computer Engineering. He came to us from the University of Rochester. He received his Ph.D. from Princeton University in 1980.

Professor Nachman's fields of interest are inverse problems, partial differential equations, and medical imaging. He has given many invited lectures in Europe and in North

America. Since 1990 he has received a number of prestigious research grants from the United States and Canada. At present, he holds an NSERC grant for Inverse Problems in Partial Differential Equations and, together with a co-investigator (M. Joy), a CITO grant for Defibrillator Current Density Imaging. He has supervised a number of graduate students.

Adrian Nachman has also participated in the organization of Workshops and Colloquia at MSRI in Berkeley and at the Fields Institute. He is a member of the Editorial Board of the journal *Inverse Problems*.

Professor Mary C. Pugh joined our department in 2001. She had previous appointments at the University of Pennsylvania, the Center for Neural Science, NYU, the Courant Institute, and the Institute for Advanced Study. Mary Pugh got her Ph.D. at the University of Chicago in 1993. Her research interests are scientific computing, nonlinear partial differential equations, fluid dynamics, and computational neuroscience.

In 1989 Mary Pugh got the Lawrence and Josephine Graves Award for teaching. She was an NSF Postdoctoral Fellow and is now an Alfred P. Sloan Fellow.

Mary Pugh's many external professional activities include organizing conferences at the Fields Institute, being on the editorial board of the *European Journal of Applied Mathematics*, refereeing articles for several professional journals, and working for SIAM in various capacities.

THE ACADEMIC YEAR 2002 - 2003

Professor Dror Bar-Natan got his Ph.D. from Princeton University in 1991 and has since taught at Harvard University and the Hebrew University of Jerusalem. He spent a sabbatical at UC Berkeley, including half a year at MSRI, and some time at the University of Toronto. He accepted a position as Associate Professor in our department in 2002. Dror Bar-Natan is a member of the Editorial Board of *Compositio Mathematica*. His research interests are quantum algebra and topology.

Professor Kentaro Hori comes to Toronto from the Institute for Advanced Study in Princeton. He accepted a position as Associate Professor, jointly with the Department of Mathematics and the Department of Physics, in Mathematical Physics. His research interests include string theory and mirror symmetry. He gave an invited lecture on mirror symmetry and quantum geometry in the Mathematical Physics section at the International Congress of Mathematicians (ICM) in 2002 in Beijing. Kentaro Hori is an Alfred P. Sloan Fellow.

Professor Robert L. Jerrard joined our department as Associate Professor in 2002, after teaching at the University of Illinois at Urbana-Champaign for seven years. He got his Ph.D. at UC Berkeley in 1994 and spent one year as Postdoctoral Fellow with the Center for Nonlinear Analysis at the Carnegie Mellon University and one year as Visiting Scientist at the Max-Planck-Institut in Leipzig, Germany. His research interests are nonlinear partial differential equations

and the calculus of variations.

Professor Yael Karshon joined the Department of Mathematical and Computational Sciences at our Mississauga Campus as Associate Professor (Algebra and Geometry) in 2002. She came to us from The Hebrew University of Jerusalem where she had taught mathematics since 1995. After her Ph.D. from Harvard in 1993, she was a C.L.E. Moore Instructor at MIT. She spent the spring of 1999 at MSRI, Berkeley, and the fall of 2000 at UC Berkeley. Her main area of research interest is symplectic geometry.

Professor Mikhail Lyubich joined our department in 2002 as a Full Professor. He is also Professor at the Institute for Mathematical Sciences and the Mathematics Department of SUNY at Stony Brook. He holds a *Canada Research Chair* at the University of Toronto. His education was in the USSR, where he earned a Master's degree from Kharkov State University in 1980 and his Ph.D. from Tashkent State University in 1984. He was awarded a prize from the Leningrad Mathematical Society in 1987. Since his move to North America he has received an Alfred P. Sloan Research Fellowship and a Guggenheim Fellowship.

Mikhail Lyubich's research is concerned with dynamical systems, hyperbolic geometry, and laminations. He has given many invited lectures in Russia, several European countries, and in North and South America. He gave an invited address at the 1994 International Congress of Mathematicians in Zürich, in the section 'Ordinary Differential Equations and Dynamical Systems'.

THE ACADEMIC YEAR 2003 - 2004

Professor Ilia Binder is joining the Mathematics Department at our Mississauga Campus. He has been Assistant Professor at the University of Illinois, Urbana-Champaign for the last two years, but spent part of the time as Visiting Assistant Professor at Yale University and the Mittag-Leffler Institute in Sweden. After his Ph.D. at the California Institute of Technology in 1997, he spent four years at Harvard University as Benjamin Peirce Assistant Professor. Ilia was a Member of the Institute for Advanced Study in 1998 – 1999. His research interests are the theory of several complex variables and dynamical systems.

Professor Grigory Mikhalkin accepted a position as Associate Professor in our department, effective July 1, 2003. He comes to Toronto from the University of Utah. He received his Ph.D. in 1993 from Michigan State University. His research interests include geometry, topology, and algebraic geometry. We will be nominating him for a Tier II *Canada Research Chair*.

Professor Michael Shub accepted a position as Full Professor in our department effective January 2004. He has been a Research Member at the Thomas J. Watson Research Center, IBM, in Yorktown Heights, New York, since 1985. Michael Shub got his Ph.D. at UC Berkeley in 1967. He has held research and teaching positions at prestigious universities and research institutions in the United States and

abroad. His research interests include dynamical systems and complexity theory.

Professor **Stevo Todorcevic** will join our department in January 2004 as Full Professor. He was Adjunct Professor at the University of Toronto for several years. He is coming to us now from the Université Paris VII. Stevo Todorcevic got his Ph.D. from the University of Belgrade in 1979. His research interests are in set theory and combinatorics. We will be nominating him for a Tier I *Canada Research Chair*.

Professor **Bálint Virág** accepted a position as Assistant Professor in the Department of Computer and Mathematical Sciences at our Scarborough Campus, effective July 2003. He comes to us from MIT, where he was C.L.E. Moore Instructor for three years, 2000-2003. He got a B.A. in Mathematics at Harvard University in 1996 and a Ph.D. in Statistics at UC Berkeley in 2000. His main research interest is probability. He holds a Tier II *Canada Research Chair*.

NEW STAFF IN THE FRONT OFFICE

Amanda Rogers started working for our department in early August 2003 as Receptionist and Secretary. Amanda, who is a graduate of the University of Toronto, is replacing Janice Andrews at the front desk. Janice will be attending Trent University to pursue a B.Ed. degree.

Seeta Parker joined us on August 20, 2003, as Secretary to the Chair. Seeta has worked within the University environment for some time. She is replacing Pat Broughton who recently took early retirement.

E. W. E.

Outstanding Faculty

JOHN B. FRIEDLANDER
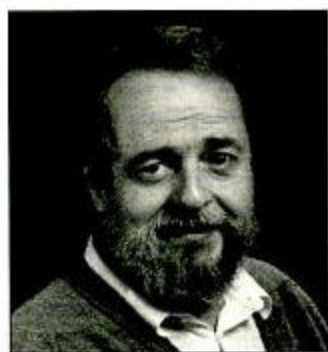
John B. Friedlander

John Friedlander is the most recent member of the Department of Mathematics to be appointed to the rank of University Professor, joining Professors J. G. Arthur and I. M. Sigal at this rank.

The University Professors' website offers the following description of this position.

"The University of Toronto owes much of its reputation and stature to the quality of its eminent professors. The University recognizes unusual scholarly achievement and pre-eminence in a particular field of knowledge through the designation of University Professor. Under our Policy and Procedures on Academic Appointments, the number of such appointments should not exceed two per cent of the tenured faculty. Its very exclusivity stands to underline the highly prestigious

nature of the University Professor designation."

The following is a slightly edited and up-dated version of the personal description of Professor Friedlander on the same website.

Professor Friedlander is widely recognized as an international leader in one of the purest branches of mathematics — analytic number theory — and in particular, a leader in the areas of prime numbers and of L-functions. The exploration of prime numbers is among the oldest endeavours in pure and abstract knowledge and new insights are generally achieved only after decades, or even centuries, of research.

A number of Professor Friedlander's earlier results, for example those on the distribution of primes in arithmetic progressions, are now tools of the trade for scientists working in this area. However, in a discipline in which it is commonly accepted that people do their best work while they are still young, one of the startling aspects of Professor Friedlander's career is that he grows deeper and more prolific with age. In 1998 work with Henryk Iwaniec, he proved that infinitely many prime numbers can be obtained as the sum of a square and a fourth power. This work reached a large audience through wide media coverage being the subject of popular articles in *Science, Science News*, and several other outlets. The work was also cited in the award to Professor Iwaniec of the 2002 Cole Prize, the leading international award for research achievements in number theory. The citation for that award states "In particular, the prize is awarded for his paper (with J. Friedlander)...", and then goes on to cite this result as well as a series of other joint works with Professor Friedlander.

Professor Friedlander has published over 90 research papers, many in the most prestigious mathematical journals, and he sustains an extremely busy schedule of lectures at conferences, workshops, colloquia, and external seminars, including a lecture in 1994 at the International Congress of Mathematicians, one of the most distinguished accolades in international mathematics.

Professor Friedlander's contribution to his field has been recognized through the award of a number of other honours, from becoming a Fellow of the Royal Society of Canada in 1988, to his recent receipt in 2002 of the distinguished CRM-Fields Prize. In 1999, he was invited to give the Jeffery-Williams Prize Lecture "in recognition of his outstanding leadership in Canadian mathematics". Most recently, he received a Killam Research Fellowship, an award made by the Canada Council to distinguished Canadian scholars who have established an outstanding reputation in their area of research.

Professor Friedlander has been a member of the University of Toronto faculty since 1977 and has served the University very well through a record of civic commitment that included the Chairmanship of the Department of Mathematics. He holds a joint appointment in the Department of Computer and Mathematical Sciences in the University of Toronto at Scarborough and in the Department of Mathematics in the Faculty of Arts and Science. In addition, Professor Friedlander has had visiting appointments at

MIT and Berkeley as well as several at the Institute for Advanced Study in Princeton. He is a dedicated teacher of undergraduates and supervisor of graduate students and postdoctoral fellows and has mentored many young mathematicians of promise and accomplishments.

G. A. E.

ECKHARD MEINRENKEN

Eckhard Meinrenken

Professor Eckhard Meinrenken of mathematics has won U of T's McLean Award, a $100,000 prize given annually for outstanding basic research [in the physical sciences and engineering].

Meinrenken combines a technical talent for highly advanced mathematics with a love for what he describes as the "elegance" of a well-reasoned solution. Although he is a mathematics professor, his Ph.D. was in physics and his research straddles the border between the two disciplines.

"I consider myself on the mathematical side of that border but I am always interested in what is happening on the other side," he said. "I work on mathematical problems that are very closely related to physics and try to use inspirations from physics in order to address mathematical problems."

More specifically, he studies symplectic geometry, a field that tries to understand the geometry of spaces originally described in physical theories that illustrated the forces between elementary particles such as electrons. Later, it was discovered that the same spaces played a role in various mathematical fields such as algebraic geometry and knot theory.

His research has garnered a 2000 Premier's Research Excellence Award and the 2001 André Aisenstadt Prize. For Meinrenken, finding the solution to a mathematical problem isn't always good enough. Instead, he said, discovering the reasons why the solution works reveals the true beauty and elegance in the equation.

"If a nice mathematical result comes along with an unattractive proof, we can be almost certain that we just don't understand the result well enough," he said.

The McLean Award was created in 1995 – 1996 by a gift of $1 million from U of T alumnus William McLean. The award is meant to support outstanding researchers relatively early in their careers by helping to attract and support graduate students and postdoctoral fellows of great promise as part of their research teams.

N. W.

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MORE AWARDS FOR FACULTY

We are pleased to congratulate several more of our colleagues who recently received prestigious awards in recognition of their work.

James Arthur was awarded an *honorary doctorate* by the University of Ottawa in 2002.

Steve Halperin was named a *Chevalier, Ordre des Palmes Académiques, France*

Victor Ivrii was awarded a *Killam Research Fellowship*

Lisa Jeffrey was awarded the *2002 CMS Coxeter-James Prize Lectureship*

Daniel Lidar received an *Alfred P. Sloan Research Fellowship* and a *PREA (Premier's Research Excellence Award)*

Robert McCann received the *Sixth Monroe H. Martin Prize* and a *PREA*

Amanda Peet received a *PREA*

Arthur Sherk received the *2000 CMS Distinguished Service Award*

Michael Sigal received the *2000 CRM-Fields Price*

Just In

HONOURED FOR OUTSTANDING ACHIEVEMENT

James Arthur will be awarded the *G. de B. Robinson Prize for 2003*. The award will be presented at the CMS 2003 Winter Meeting Banquet on December 7th, 2003, at the Pan Pacific Hotel in Vancouver, BC.

He has also been elected to the *American Academy of Arts and Science* as *Foreign Honorary Member*. The citation states, "Arthur is a highly sought-after expert on the international scene whose groundbreaking work has had tremendous impact on several key fields of mathematics."

We are delighted to announce that Jim Arthur has just been elected *President of the American Mathematical Society*. He will be President Elect for the year February 2004 – January 2005 and President for the period February 2005 – January 2007. This is yet more well-deserved recognition for Jim.

E. W. E.

Recent Books By Faculty

Edward Barbeau, *Pell's equation*. Problem Books in Mathematics. Springer-Verlag, New York, 2003

M. J. Evans and J. S. Rosenthal, *Probability and statistics: the science of uncertainty*. W. H. Freeman, New York, 2003

Ian Graham and Gabriela Kohr, *Geometric function theory in one and higher dimensions*. Marcel Dekker Inc., New York, 2003

S. Gustafson and M. Sigal, *Mathematical concepts of quantum mechanics*. Springer, 2003

Kentaro Hori, S. Katz, A. Klemm, R. Pandharipande, R. Thomas, C. Vafa, R. Vakil, and E. Zaslow, *Mirror symmetry*. American Mathematical Society, Clay Monographs 1, 2003

Heydar Radjavi and Peter Rosenthal, *Invariant subspaces* (2nd ed.). Dover, 2003

Heydar Radjavi and Peter Rosenthal, *Simultaneous triangularization*. Springer-Verlag, 2000

J. S. Rosenthal, *A first look at rigorous probability theory*. World Scientific Publishing Company, Singapore, 2000

John Scherk, *Algebra: a computational introduction*. Studies in Advanced Mathematics. Chapman and Hall/CRC, Boca Raton, FL 2000

Catherine Sulem and Pierre-Louis Sulem, *The nonlinear Schrödinger equation: self-focusing and heat collapse*. Applied Mathematical Sciences, Volume 139, Springer, 1999

E. J. B.

The Graduate School Theses and Awards

We are proud to have attracted excellent graduate students over the years. Each fall we start with about eighty to ninety graduate students who stay with us for a number of years. Many of them finish their graduate studies successfully with a Master of Science degree (M.Sc.). The list of Ph.D. students below speaks for itself, and so does the list of prestigious awards that a number of them have received for the outstanding work that was done.

PH.D. RECIPIENTS 2000 - 2003

1. 2000

CALIN, Ovidiu — Supervisor: Peter Greiner (Differential Geometry) — Thesis: The Missing Direction and Differential Geometry on Heisenberg Manifolds

DERANGO, Alessandro — Supervisor: Man-Duen Choi (C*-Algebras) — Thesis: On C*-Algebras Associated with Homeomorphisms of the Unit Circle

HIRSCHORN, James — Supervisor: Stevo Todorcevic (Set Theory) — Thesis: Cohen and Random Reals

MADORE, Blair — Supervisor: Andrés Del Junco (Ergodic Theory) — Thesis: Rank One Group Actions with Simple Mixing Z Subactions

MARTÍNEZ-AVENDAÑO, Rubén — Supervisor: Peter Rosenthal (Operator Theory) — Thesis: Hankel Operators and Generalizations

MERKLI, Marco — Supervisor: Israel Michael Sigal (Mathematical Physics) — Thesis: Positive Commutator Method in Non-Equilibrium Statistical Mechanics

MIGHTON, John — Supervisors: John Bland and Kunio Murasugi (Knot Theory) — Thesis: Knot Theory on Bipartite Graphs

MOORE, Justin — Supervisor: Stevo Todorcevic (Set Theory) — Thesis: Topics in Ramsey Theory of Sets of Real Numbers

RAZAK, Shaloub — Supervisor: George Elliott (Operator Algebras) — Thesis: Classification of Simple Stably Projectionless C*-Algebras

SCOTT, Jonathan — Supervisor: Steve Halperin (Algebraic Topology) — Thesis: Algebraic Structure in Loop Space Homology

ZHAN, Yi — Supervisor: Luis Seco (PDE) — Thesis: Viscosity Solutions of Nonlinear Degenerate Parabolic Equations and Several Applications

2. 2001

COLEMAN, James — Supervisor: Catherine Sulem (Nonlinear PDE) — Thesis: Blowup Phenomena for the Vector Nonlinear Schrödinger Equation

IZADI, Farz-Ali — Supervisor: Askold Khovanskii (Differential Geometry) — Thesis: Rectification of Circles, Spheres, and Classical Geometries

KERR, David — Supervisor: George Elliott (Operator Algebras) — Thesis: Pressure for Automorphisms of Exact C*-Algebras and a Non-Commutative Variational Principle

OLIWA, Chris — Supervisor: Charles Dyer, Department of Astronomy (Mathematical Physics) — Thesis: Some Mathematical Problems in Inhomogeneous Cosmology

PIVATO, Marcus — Supervisor: Luis Seco (Mathematical Finance) — Thesis: Analytical Methods for Multivariate Stable Probability Distributions

POON, Edward — Supervisor: Chandler Davis (Operator Theory) — Thesis: Frames of Orthogonal Projections

SAUNDERS, David — Supervisor: Luis Seco (Mathematical Finance) — Thesis: Mathematical Problems in the Theory of Incomplete Markets

SOLTYS-KULINICZ, Michael — Supervisor: Steven Cook, Department of Computer Science (Complexity) — Thesis: The Complexity of Derivations of Matrix Identities

VASILIJEVIC, Branislav — Supervisor: Israel Michael Sigal (Mathematical Physics) — Thesis: Mathematical Theory of Tunneling at Positive Temperatures

YUEN, Wai Kong — Supervisor: Jeffrey Rosenthal, Department of Statistics (Probability) — Thesis: Application of Geometric Bounds to Convergence Rates of Markov Chains and Markov Processes on R(n)

3. 2002

HERNANDEZ-PEREZ, Nicholas — Supervisor: Luis Seco (Mathematical Finance) — Thesis: Applications of Descriptive Measures in Risk Management

KAVEH, Kiumars — Supervisor: Askold Khovanskii (Algebraic Geometry) — Thesis: Morse Theory and Euler Characteristic of Sections of Spherical Varieties

MOHAMMADALIKHANI, Ramin — Supervisor: Lisa Jeffrey (Symplectic Geometry) — Thesis: Cohomology Ring of Symplectic Reductions

SOPROUNOV, Ivan — Supervisor: Askold Khovanskii (Algebraic Geometry) — Thesis: Parshin's Symbols and Residues, and Newton Polyhedra

SOPROUNOVA, Eugenia — Supervisor: Askold Khovanskii (Algebraic Geometry) — Thesis: Zeros of Systems of Exponential Sums and Trigonometric Polynomials

TOMS, Andrew — Supervisor: George Elliott (Operator Algebras) — Thesis: On Strongly Perforated K_0-Groups of Simple C^*-Algebras

VUKSANOVIC, Vojkan — Supervisor: Stevo Todorcevic (Set Theory) — Thesis: Canonical Equivalence Relations

ZIMMERMAN, Jason — Supervisor: Velimir Jurdjevic (Control Theory) — Thesis: The Rolling Stone Problem

4. 2003

ADAMUS, Janusz — Supervisor: Edward Bierstone (Algebraic Geometry) — Thesis: Vertical Components in Fibre Powers of Analytic Mappings

BUBENIK, Peter — Supervisor: Paul Selick (Algebraic Topology) — Thesis: Cell Attachments and the Homology of Loop Spaces and Differential Graded Algebras

HO, Nan-Kuo — Supervisor: Lisa Jeffrey (Symplectic Geometry) — Thesis: The Moduli Space of Gauge Equivalence Classes of Flat Connections over a Compact Nonorientable Surface

JONG, Peter — Supervisor: Andrés Del Junco (Ergodic Theory) — Thesis: On the Isomorphism Problem of p-Endomorphisms

PEREIRA, Rajesh — Supervisor: Man-Duen Choi (Operator Theory) — Thesis: Trace Vectors in Matrix Analysis

STAUBACH, Wolfgang — Supervisor: Peter Greiner (PDE) — Thesis: Path Integrals, Microlocal Analysis and the Fundamental Solution for Hörmander Laplacians

THERIAULT, Nicolas — Supervisor: V. Kumar Murty (Number Theory) — Thesis: The Discrete Logarithm Problem in the Jacobian of Algebraic Curves

TING, Fridolin — Supervisor: Israel Michael Sigal (Mathematical Physics) — Thesis: Pinning of Magnetic Vortices by External Potential

TSANG, Kin Wai — Supervisor: George Elliott (Operator Algebras) — Thesis: A Classification of Certain Simple Stably Projectionless C^*-Algebras

AWARDS (2000 - 2003)

To recognize outstanding thesis work, the Department presents the Malcolm Slingsby Robertson Graduate Award to graduating Ph.D. students who have demonstrated excellence in research.

2000: Rubén Martínez-Avendaño
2001: David Kerr and David Saunders
2002: Ivan Soprounov

The Natural Sciences and Engineering Research Council of Canada gives outstanding Canadian Ph.D.'s the opportunity to continue their research by awarding them NSERC Postdoctoral Fellowhips.

2000: Marco Merkli and Jonathan Scott
2001: David Kerr and David Saunders
2002: Andrew Toms
2003: Janusz Adamus and Ramin Mohammadalikhani

In addition, there were two more awards given:

2000 Canadian Applied and Industrial Mathematics Society Dissertation Award: Stephen Gustafson

2001 Canadian Mathematical Society Doctoral Prize: David Kerr

M.-D. C.

The Tobermory Walk 'It Never Rains'
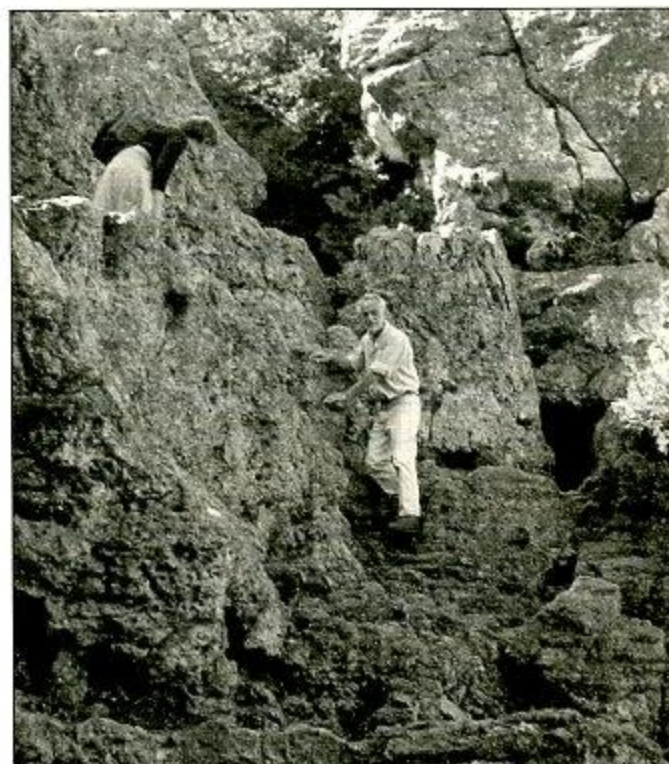
The last weekend in September — this is the Tobermory weekend where we walk the whole Saturday and climb rocks on Sunday morning. We say good-bye to the summer and take a deep breath before all the winter work begins. Without doubt, Tobermory, at the tip of the Bruce Peninsula, is the most beautiful and also the most challenging part of the Bruce Trail which stretches for 400 miles between Hamilton and, yes, Tobermory.

Way back when, around 1970, the math department started walking. We walked weekends on the Bruce Trail in early fall, with kit and caboodle, and we had a wonderful time. Finally, Tobermory was born, the brainchild of Werner Greub and Steve Halperin — and the enthusiasm was catching. Some of us hardly left out a year, and by now the third generation has taken part in the hikes. From all over the world, visiting mathematicians and their families joined in.

When Ragnar Buchweitz's now grown-up son, Ingmar, was about seven years old, he was overheard asking another child: "Have you ever been here before?" Not satisfied with some lukewarm answer, he asked: "I mean, have you ever been at THIS EVENT ?!"

We show you some beautiful photos here which were taken by Olga Ivrii last year. Graham Leuschke was this year's photographer.

You can see the whole collection of Graham's seventeen marvellous photos of the Tobermory hike by clicking on http://www.leuschke.org/Tobermory03/

Would you like to be part of THIS EVENT next year? Just contact us at the beginning of September.

Wanderlust — wonderful!

E. W. E.

Hot Times In The Greenhouse

The mathematics department has been growing and growing and growing. It's no wonder that our Sidney Smith quarters have become more and more crowded! Everybody likes to be in Sid Smith—to be close to the centre of the department where most colleagues, the secretarial staff, the computers, and students are. On the other hand, it can be idyllic to be away from the hustle and bustle, to be in a suite environment where one can easily meet and work with a few colleagues or students. At least temporarily, the Greenhouse has helped with the space crunch by providing the math department with a pair of suites.

In January 2003, five faculty and two post-docs moved to the third floor of the new Greenhouse Annex of the Earth Sciences Building. Located at Huron and Russell, one block

south of Sidney Smith, the annex has four floors with six offices per floor. The group of applied mathematicians, Rob Almgren, Jim Colliander, Bob Jerrard, Hamed Maroofi, Robert McCann, Mary Pugh, and Dejan Slepcev volunteered for the move because they form a coherent group with common research interests and they would have stronger interactions in the annex than in Sidney Smith. Also, they are now one block closer to the Fields Institute which is especially nice since 2003 – 2004 is a focus year on partial differential equations at Fields, and they are now closer to their favorite lunch spots.

In August 2003, the greenhouse gang grew, gaining three faculty and six post-docs and broadening to include analysts and probabilists: Victor Ivrii, Lars Jonsson, Xiaosong Kang, Georgia Karali, Sara Maad, Adrian Nachman, Emmanuelle Servat, Alex Tamasan, and Bálint Virág. The arrival of this second wave was celebrated with a department reception, organized by Lars Jonsson and Georgia Karali, with the guidance of Robert McCann. The Greenhouse is looking forward to exciting times in the years ahead (while the math department is looking forward to move some day into a new building, one that will be large enough to house all faculty, graduate students, and administrative staff under one roof).

M. C. P.

The Computer Advances

The computer system of the Department of Mathematics was created from NSERC equipment grants in the mid-1980's. Wiring connecting all of the faculty offices to the system took place in the early 1990's. As the department itself has expanded, the facility has expanded over the past five years to include equipment in mathematics offices in 1 Spadina, the Earth Sciences building, and a research computer lab which was recently created in Whitney Hall.

Initially the greatest effect of the computer system on the way mathematics is done was through the instant communication provided by electronic mail. Since its inception, almost all members of the department have used the computer system to discuss their work with their collaborators. Formerly, an exchange of letters by regular mail would often take two weeks, but collaborators can now exchange messages in minutes. This remains one of the greatest benefits of the computer age to mathematical research.

Another effect of the computer age on the distribution of mathematics is the development of the TEX word-processing system. Virtually all mathematics reprints are now created using the TEX family of programs. Its universal acceptance by the mathematical world means that members of our department can send and receive manuscripts via e-mail with the assurance that their documents will be decipherable at the other end, and that the mathematical symbols will appear as intended. Exams and class handouts can be prepared with the mathematical symbols typeset properly

and the possibility of ambiguity greatly reduced.

Some members of the department use the computer system's more traditional role to assist their research — intensive calculations. For many, this process was simplified in the early 1990's with the development of higher level computer languages such as *Mathematica*, *Maple*, *Matlab*, and many others which contain built-in functions for common mathematical operations which would otherwise have to be programmed "by hand" in the more traditional languages. Additionally, as computer screens have improved and processing speed increased, it has become standard in many branches of mathematics to use computer-generated graphics to gain intuition on mathematical problems.

The biggest recent change in the way computers are used by the department is the development of the internet over the past ten years. Preprint servers allow one to read papers before they actually appear in the journals. Similarly, members of our department can consult the American Mathematical Society's "Math Reviews" on-line, since the University's library has purchased an on-line subscription in addition to the paper copies. Furthermore, since most have home computers with the capability of connecting to the computer system, this access is available from both home and office. The internet is also playing an increasingly greater role in undergraduate mathematics classes. Many courses now have their own Web site containing computer copies of handouts and old exams as well as administrative material such as the location and times of lectures, exams, etc. Both students and faculty also have access to information on various topics in mathematics which might be available on the Web sites at other universities.

Computers have had a large effect on how the members of our department teach, do research, and communicate their results. However, while computers have greatly simplified the creation and dissemination of mathematics and can even play a superior game of chess — they have so far been quite ineffective at actually proving theorems!

P. S.

Deaths In The Department

It is with deep regret that we announce the deaths of five of our colleagues during the last three years. All had been highly appreciated members of the Department for many years.

R. A. (Rod) Ross (1926 – 2001)

Rod Ross received his university education in Toronto, finishing in 1958 with a Ph.D. in applied mathematics. He joined the faculty of our department the same year, starting as lecturer. Rod was a well-liked, cheerful colleague and, although modest, an excellent conversationalist at social gatherings. He was well-travelled and possessed a vast knowledge. Rod's mathematical research interest was in wave propagation. He was an enthusiastic teacher and

supervised several Ph.D. students. His students appreciated Rod's lectures greatly, so much so, that he was asked to continue teaching the engineering students after his retirement in 1991. Rod died of a sudden heart attack on January 15, 2001, in the middle of a still busy academic year.

G. F. D. (George) Duff (1926 – 2001)

George Duff had a distinguished career, both as a mathematician and an administrator. He got his Ph.D. from Princeton University in 1951. He joined our department in 1952. George was an ardent applied mathematician. His research was in partial differential equations, in particular, the Navier-Stokes equation, and, after developing a theory of the tides in the Bay of Fundy, investigations into the possibilities of power production from these tides. He was deeply concerned about the exploitation of our planet and the natural environment. George published more than sixty scientific papers and several books. He supervised twelve Ph.D. students.

George Duff was Chairman of our department from 1968 to 1975. He was editor of the *Canadian Journal* 1957 – 1961 and again 1978 – 1981. He was awarded an honorary doctorate in 1994 from Dalhousie University, Halifax, and was president of the Canadian Mathematical Society 1971 – 1973. George was elected a Fellow of the Royal Society of Canada in 1959. He died on March 2, 2001.

J. R. (Ray) Vanstone (1933 – 2001)

Ray Vanstone did his undergraduate studies at the University of Toronto and got his Ph.D. in Natal, South Africa, in 1959. He joined our department as a lecturer of mathematics in the same year. Ray wrote papers in multilinear algebra and on differential geometry as it relates to relativity. He collaborated with Werner H. Greub and Stephen Halperin on the well-known three-volume book *Connections, Curvature, and Cohomology*. Ray served the Mathematics Department and also the Canadian Mathematical Society loyally in many capacities. He was Associate Chair of the department from 1970 to 1975 and taught at all three campuses (St. George, Erindale, and Scarborough). He had a deep interest in mathematical education and furthered the interaction between high school and university.

Ray was a passionate mathematician and a dedicated teacher and friend. He was generous almost to a fault and would go out of his way to help whenever he felt it was necessary. He died on April 9, 2001.

F. V. (Derick) Atkinson (1916 – 2002)

Derick Atkinson was an eminent mathematician, well known throughout the world. He was a dedicated and successful researcher. He wrote very well received books on discrete and continuous boundary problems and on multiparameter eigenvalue problems. A last book is at present being prepared for publication by one of his most loyal friends and former students, himself a gifted mathematician, Angelo Mingarelli. Derick Atkinson produced over a hundred scientific publications in the field of differential equations. Some of his work was translated into other languages. Derick spoke several languages himself, among them Hungarian, Russian, and German. He was a revered teacher and supervised six Ph.D. students.

Derick travelled widely and was welcomed as collaborator and lecturer at numerous research institutes, universities, and conferences.

Derick's achievements were rewarded by many honours. He was a Fellow of the Royal Society of Canada and an Honorary Fellow of the Royal Society of Edinburgh. He was awarded the McDougall-Brisbane prize of the Royal Society of Edinburgh and the prestigious Alexander von Humboldt-Forschungspreis of Germany.

Derick was a member of the Canadian Mathematical Society where he served on its board of directors and on many of its committees. From 1989 to 1991 he was its president. He was on the advisory board of a number of highly regarded mathematical journals such as the *Mathematische Nachrichten*.

Born and educated in England, Derick received his Ph.D. from the University of Oxford in 1939. Throughout World War II, he served in the British army. After the war, Derick taught in Oxford, Nigeria, and Australia. He joined the Department of Mathematics at the University of Toronto in 1960.

From 1975 to 1981 Derick was Chairman of the Department of Mathematics in Toronto. Derick's quiet and dignified personality, clear vision, determination, and understanding were eminently suited for this position. He handled his administrative duties perfectly while he continued his excellent research. He died on November 13, 2002.

H. S. M. (Donald) Coxeter (1907 – 2003)

Harold Scott MacDonald Coxeter died on March 31, 2003, after 67 years as professor at the Department of Mathematics of the University of Toronto.

Donald Coxeter was a passionate geometer who was devoted to aesthetically appealing problems. It is not surprising that he was a friend and admirer of the Dutch graphic artist M. C. Escher.

Donald was a man with a vision and pursued mathematics as a form of art. His whole life was devoted to the discovery and the description of the symmetries that exist in the Euclidean spaces of various dimensions. He studied the mathematics of frieze patterns and crystals. His research into symmetries led him to the structures that are now called Coxeter groups. He made major and fundamental contributions to this subject which have influenced many other branches of mathematics.

Donald Coxeter was born and educated in England. He received the degree of Ph.D. in 1931 at the University of Cambridge and was a research fellow at Trinity College, Cambridge, from 1931 to 1936. Two prestigious fellowships allowed him to spend two years at Princeton. In 1936, Donald joined the Department of Mathematics at the University of Toronto.

and national mathematics contests. Prior to leaving for the IMO, the team trained at the University of Calgary and the Banff International Research Station in Alberta from June 24th to July 10th, 2003.

The Canadians competed with 451 of the world's best students from more than eighty other countries. Canada came 12th this year. The 2003 IMO contest was set by an international jury of mathematicians, one from each participating country.

Two Gold Medals were awarded to members of the Canadian team, namely to Olena Bormashenko (Don Mills Collegiate Institute) and Jacob Tsimerman (University of Toronto Schools). Robert Barrington Leigh (Old Scona Academic High School, Edmonton), Tianyi (David) Han (Woburn Collegiate Institute), and Oleg Ivrii (Don Mills Collegiate Institute) were awarded Bronze Medals.

Olena Bormashenko is the first Canadian female student to win an IMO gold medal and Jacob Tsimerman is the youngest Canadian student ever to win an IMO gold medal.

Sponsors of Canada's 2003 IMO team include Provincial Ministries of Education; the Banff International Research Station (BIRS); Sun Life Financial; the Samuel Beatty Fund; Maple Software Inc; Centre de recherches mathématiques (CRM); the Fields Institute for Research in Mathematical Sciences; the Pacific Institute for the Mathematical Sciences; the Departments of Mathematics and Statistics of several Canadian Universities; and the Canadian Mathematical Society.

The 45th International Mathematical Olympiad will take place in Athens, Greece, from July 4th to 18th, 2004.

We are very grateful to the large number of our colleagues who are actively supportive, helping to bring about the success of all these endeavours.

O. I.

List Of Honours For Faculty and Staff Since 2000

Alfred P. Sloan Research Fellow:
James Colliander - Kentaro Hori - Daniel Lidar - Mary Pugh
American Academy of Arts and Science, Foreign Honorary Member:
James Arthur
American Mathematical Society Centennial Fellow:
Henry Kim (2003-2004)
American Mathematical Society Presidency:
James Arthur (President Elect February 2004 – January 2005; President February 2005 – January 2007)
André Aisenstadt Prize:
Eckhard Meinrenken (2000)

Canada Research Chair:
George Elliott - Mikhail Lyubich - Bálint Virág (Tier II)
Canadian Mathematical Society Coxeter-James Prize Lectureship:
Lisa Jeffrey (2002)
Canadian Mathematical Society Distinguished Service Award:
Arthur Sherk (2000)
Canadian Mathematical Society G. de B. Robinson Prize:
James Arthur (2003)
Canadian Mathematical Society Jeffery-Williams Prize Lectureship:
John Friedlander (2001)
Canadian Mathematical Society Krieger-Nelson Prize Lectureship:
Lisa Jeffrey (2001)
Chevalier, Ordre des Palmes Académiques, France:
Stephen Halperin
CRM-Fields Prize:
Michael Sigal (2000) - John Friedlander (2002)
Faculty of Arts and Science Dean's Student Life Award:
Marie Bachtis (2000)
Faculty of Arts and Science Outstanding Teaching Award:
Dietrich Burbulla (2000)
Fields Institute Fellow:
James Arthur - Edward Bierstone - Stephen Cook - H.S.M. Coxeter - George Elliott - John Friedlander - Stephen Halperin - Kumar Murty - Luis Seco - Michael Sigal
Guggenheim Fellow:
James Arthur - Mikhail Lyubich
Honorary Doctorate:
James Arthur (University of Ottawa)
ICM (International Congress of Mathematicians) invited Speaker:
Kentaro Hori - Eckhard Meinrenken
Killam Fellow:
John Friedlander - Victor Ivrii
Ludwig and Estelle Jus Memorial and Human Rights Prize:
Peter Rosenthal (2000)
Malcolm S. Robertson Chair:
Michael Sigal
McLean Award:
Lisa Jeffrey (2000) - Eckhard Meinrenken (2003)
PREA (Premier's Research Excellence Award):
Robert McCann - Daniel Lidar - Eckhard Meinrenken - Amanda Peet - Michael Yampolsky
Principal's Research Award, U of T at Scarborough:
Lisa Jeffrey (2002)
Sixth Monroe H. Martin Prize:
Robert McCann
Ted Mossman Chair:
Mikhail Kapranov
University Professor:
John Friedlander (appointed 2002)
Wilbur Lucius Cross Medal of the Yale Graduate School Alumni Association:
James Arthur
Young Explorers Prize of the Canadian Institute for Advanced Research:
Daniel Lidar