Pacific Institute *for the* Mathematical Sciences

Alberta, US, and Mexican Governments to Give Full Funding for the Banff International Research Station

Three months after a thorough international review of the Banff International Research Station (BIRS), the Alberta government—at the recommendation of the Alberta Science Research Agency (ASRA)—has pledged $CAD 3,424,000 in support of the scientific activities of BIRS for a period of five years starting in 2006 (see page 4 for the official award letter from Minister Victor Doerksen). This decision came at the heels of a recommendation by the Division of the Mathematical Sciences (DMS) of the National Science Foundation for the full funding ($US 2,641,500) of

New Chair of the PIMS Board of Directors

In June 2005 Brian Russell (Vice President, Veritas DGC Inc, Calgary) became the new Chair of the PIMS Board of Directors.

To read an interview with Brian turn to page 5.

BIRS for the next 5 years, coupled with a pledge of $CAD 550,000 from Mexico's CONACYT for this groundbreaking North American collaboration. In addition, the Universidad Nacional Autónoma de Mexico (UNAM) has committed substantial funds to support Mexican participants in BIRS activities.

NSERC's decision however, has been regrettably delayed until April 2006. In view of this delay, the NSERC executive has extended the old BIRS grant by one year. This delay is due to a serious restructuring that is currently under consideration within NSERC's Research Grants Programme. The current *Major Facilities Access* (MFA) envelope is in the process of being redesigned to reflect major international collaborative initiatives such as BIRS. As of the day of writing this, we are still awaiting the new criteria/guidelines affecting such a programme and consequently the funding decision for BIRS.

Inside this Issue

University of Regina, Now a PIMS Affiliate

We are pleased to announce that the University of Regina is joining PIMS as an affiliated institution. The contact person for PIMS at the University of Regina is Shaun Fallat. He is an Associate Professor in the Department of Mathematics and Statistics. Katherine Bergman, Dean of Science, is the University of Regina representative who will be at PIMS Board meetings as an observer.

PIMS Collaborative Research Groups: New and Ongoing

Please see pages 16–20.

Rustum Choksi New SFU Site Director

Rustum Choksi became the new PIMS Site Director at Simon Fraser University on September 1, 2005.

Rustum Choksi is an Associate Professor of Applied and Computational Mathematics in the Department of Mathematics at SFU.

Dr. Choksi received his PhD from Brown University in 1994. He held postdoctoral positions at the Courant Institute, 1995–97, and the Center for Nonlinear Analysis at Carnegie-Mellon University, 1994–95.

Rustum Choksi, SFU

Director's Notes

We all know how important BIRS has been to the Canadian mathematical community. This is why PIMS has put a major effort into the BIRS renewal—writing a new proposal and preparing the site visit. This effort has met with the strong support of the Canadian and US scientific community, and also, for the first time, the Mexican scientific community. As I write, it appears that BIRS will be getting the full funding we requested from ASRA, NSF, and CONACYT in Mexico, the NSERC part still being under discussion. Such success would not have been possible without the commitment and leadership of Nassif Ghoussoub, the Scientific Director of BIRS, David Eisenbud, the Director of MSRI, José Antonio de la Peña, the Director of the Mathematics Institute at Universidad Nacional Autónoma de Mexico (UNAM), and Arvind Gupta, the Scientific Director of MITACS. We also owe a great deal to the vision and leadership of the Alberta government, who have recognized the strategic importance of BIRS, and who have been steadfast supporters of PIMS from the very early days. This means that, right through to 2010, Banff will continue to attract the best scientists in the world, and that the mathematical community will continue to benefit from their presence.

PIMS has seized the opportunity to develop working ties with UNAM. PASI 2005 in Santiago gave us the opportunity to develop similar ties with CMM, the Center of Mathematical Modelling at the University de Chile. A delegation from CMM visited PIMS last May, and already in 2005 two workshops have been organized to explore topics of common interest in pure and applied mathematics. A PIMS/UNAM summer school in algebra will take place at BIRS next July. Our vision is to launch International Collaborative Research groups with CMM and UNAM, to start next year, and to develop them into a network encompassing all of Latin America. The PIMS community would benefit from the specialized expertise and industrial connections of UNAM and CMM, and

from an influx of graduate students from Latin America.

You will also notice that PIMS and MSRI are launching a Pacific Rim initiative by convening in Banff the directors of the leading mathematical institutes of the region. The responses we have had have been enthusiastic, which indicates there is a clear desire for scientific cooperation between our institutions.

Indeed challenges are now global in science as in economics and politics, and the solutions have to be sought globally. There is a great need for more science and more scientifically literate people around the world.

There is no science without mathematics. We cannot afford to let interest for science and mathematics slip in our society, nor to write off large segments of our population as being less prone to scientific education. On the contrary, as Barbara Keyfitz so aptly says later in this newsletter, we need to bring into science people from as many origins as possible, because we are facing a greater variety of problems than in the past, and we need more imagination to tackle them. Certainly, mathematics has changed tremendously since I began working in the field, and so have the applications which used to be limited to engineering and now stretch to biology, finance, and beyond. I feel it is also much more fun and exciting to do mathematics now.

We should be able to convey this sense of fun and excitement to society at large, particularly the younger generation. Traditionally PIMS has been very good at that. Our outreach and education activities, such as Pi in the Sky, GIMMC and IPSW, Math Fairs, ELMACON and Math Mania continue to be huge successes. In addition, PIMS has been encouraged by the BC government to launch an education initiative towards First Nations communities. Preliminary contact has been established, and we also expect to benefit from the experience of the University of Regina. The university has already collaborated with First Nations communities.

Which brings me to my next piece of news. I

Ivar Ekeland, PIMS Director, and Alejandro Adem, PIMS Deputy Director.

am pleased to welcome our newest affiliate, the University of Regina, to the PIMS community.

This year and next see the start of five new Periods of Concentration of PIMS Collaborative Research Groups. Five other CRGs are winding down their activities, and I am very grateful to everyone involved for making this programme so successful and varied.

I would like to conclude with a word of thanks, and a challenge. The word of thanks goes to Michael Boorman, who is retiring from the PIMS Board and from academic life. He has been an outstanding chair of the board, always ready with advice and support, and an excellent friend in times of need. The challenge goes to the PIMS community. PIMS is a collective effort. In a few years, it has established itself at the forefront of the international mathematical scene. The success of BIRS, for instance, and of the Vancouver bid for ICIAM 2011, can be ascribed to the strong scientific presence of PIMS. But this is a very competitive world, and new powers are emerging especially in science. Not only do we want to maintain our position but also to take on the challenges of growth and expansion with the many international opportunities that we are creating. To realize this we must continue to be strong, and this ultimately relies on the will of the individual PIMS scientists. I challenge the PIMS community to put forward scientific proposals that reflect the enthusiasm and innovative spirit of our community.

Ivar Ekeland, PIMS Director

Call for Scientific Proposals in the Mathematical Sciences

PIMS now welcomes applications for support for conferences, workshops, seminars and related activities in the Mathematical Sciences, to occur after April 1, 2006. PIMS also invites scientists of PIMS universities to submit letters of intent for a Period of Concentration of a PIMS Collaborative Research Group.

The deadline for applications is September 30, 2005. The results will be announced by January 31, 2006.

For more information please see: **http://www.pims.math.ca/Scientific_Programme/Call_for_Proposals/**.

The PIMS Board of Directors has submitted a letter asking NSERC's Council to consider the initiation of, and investment in, a functional and proactive international department at NSERC that effectively promotes foreign research investments in Canada and which seriously assists Canadian researchers in their collaborations with other countries. We have also asked for the prompt structuring of a new NSERC programme/envelope that deals with truly collaborative international projects such as BIRS—one that is flexible enough to react to international partnerships and to adapt appropriately to other countries timetables, evaluation procedures and their willingness to invest in scientific research on Canadian soil.

The Next Phase of BIRS: Highlights of the Changes

• Expand the North American partnership by involving the Mexican mathematical community in the scientific management of BIRS and in its operations.
• Increase the BIRS opportunities by extending the programme from 40 weeks in 2005, to 44 weeks in 2006 and to 48 weeks per year beginning in 2007.
• Coordinate a global effort to secure travel support to the station for its invited participants.
• Strengthen BIRS' commitment to Women in Mathematics and other underrepresented groups by providing continued support to their initiatives and their organizations.
• Intensify the involvement of BIRS in K–12 education, including teacher training.
• Improve the dissemination of all research and educational material developed at BIRS.
• Develop a more robust evaluation and assessment system for the impact of BIRS.

In terms of the scientific management of the station, the following changes have been implemented in conjunction with the recommendations of the joint site visit panel by the four funding agencies.

• All programmes will be reviewed and adjudicated by the BIRS Scientific Advisory Board (SAB). This body is the only one given the authority to accept or reject proposals for scientific activities, be it workshops, summer schools or hot topics. The Programme Committee will consist of 10 members of the SAB. It will stress scientific excellence while seeking to ensure the adequate representation of all areas of the mathematical sciences, as well as an appropriate geographic balance among organizers.
• The Executive Committee consisting of the directors of PIMS, MSRI, MITACS and UNAM will form a separate body dealing with issues pertaining to management. The Scientific Director of BIRS will be the liaison between this committee and the SAB. No institute director will be asked to serve on the BIRS Scientific Advisory Board.
• The requirement to have a Canadian and American organizer for each 5-day workshop will be removed. The competition will be open to all, excellence will be the primary criterion, seeking to have diversity among the organizers so that a broad spectrum of mathematical sciences will be represented at BIRS.

The main goal in implementing the changes above is to ensure the existence of a transparent and uniform governance structure, that will enable BIRS to attract the best proposals from all over the world.

Contributed by Nassif Ghoussoub, Scientific Director, BIRS

BIRS SITE VISIT: An Historic Collaborative Multinational Effort

Representives from four different governments (NSERC, ASRA, CONACYT and the NSF) joined an unprecedented collaborative effort to evaluate the scientific merits of BIRS and to decide in tandem about the renewal of their funding. This culminated in a site visit to BIRS on March 21, 2005 by a committee of experts representing the four agencies. The scientific community came out in strength to support the station as a unique international resource. More than 500 letters of testimonials in support of BIRS were received from all over the world (see **http://www.pims.math.ca/birs/publications/BIRS_testimonials_8-Mar-2005.pdf**). We are particularly grateful to the following academic and scientific leaders who actively participated in making the case for BIRS at the site visit:

Alejandro Adem (Deputy Director, PIMS)
Shelley Alvarado (Managing Director, BIRS)
Don Brooks (Associate VP Research, UBC)
Hermann Brunner (AARMS Director, Memorial U.)
David Brydges (Canada Research Chair in Math Physics, UBC)
James Carlson (President, Clay Institute)
José Antonio de la Peña (Director, Mathematics Institute, UNAM)
Eddy Campbell (Provost, Memorial U. and CMS President)
Bob Church (Chair Emeritus, ASRA)
Rene Drucker Colin (VP Research, UNAM, Mexico)
Ivar Ekeland (Director, PIMS)
David Eisenbud (Director, MSRI)
Nassif Ghoussoub (Scientific Director, BIRS)
Isidoro Gitler (Head, CINVESTAV, Mexico)
Randy Goebel (ICORE Director, U. Calgary)
Mark Green (Director, IPAM)
Arvind Gupta (Scientific Director, MITACS)
Helmut Hofer (Professor of Mathematics, Courant Institute, NYU)
Mary Hofstetter (President and CEO, The Banff Centre)
Ron Irving (Dean of Natural Sciences, U. Washington)
Ken Jackson (President, CAIMS)
Gary Kachanoski (VP Research, U. Alberta)
John Kenna (CEO, Ballard Power Systems)
Maria Klawe (Dean, Princeton)
Rachel Kuske (Associate Professor of Mathematics, UBC)
François Lalonde (Director, CRM)
Barbara Lee Keyfitz (Director, Fields Institute)
Mark Lewis (Canada Research Chair in Math Biology, U. Alberta)
Robert Miura (Professor of Mathematical Sciences and of Biomedical Engineering, NJIT)
Charles Newman (Director, Courant Institute, NYU)
Michael Plischke (Dean of Science, SFU)
Keith Promislow (Associate Professor of Mathematics, Michigan State U.)
Nancy Reid (President, SSC, U. Toronto)
Dennis R. Salahub (VP Research, U. Calgary)
Martin Taylor (VP Research, U. Victoria)
Selim Tuncel (Chair, Mathematics Department, U. Washington)

Alberta
Minister of Innovation and Science
402 Legislature Building
Edmonton, AB T5K 2B6

July 7, 2005

Dear Dr. Ekeland:

In 2004 the Government of Alberta released its visionary blueprint for the future entitled "*Today's Opportunities, Tomorrow's Promise: A Strategic Plan for the Government of Alberta.*" The plan outlined four areas of focus for the next twenty years, one of which is "Unleashing Innovation."

Building the research capacity of this province is critical to unleashing the innovation that will drive Alberta's knowledge-based economy. With this goal in mind, the Government of Alberta has been examining the issues around building research capacity in the province's strategic priority areas of energy, life sciences and information and communications technology.

In March 2005, Alberta Innovation and Science, in collaboration with the Natural Sciences and Engineering Research Council and the National Science Foundation, conducted a site visit of the Banff International Research Station (BIRS). The site visit committee assessed BIRS' achievements, future plans, and request for renewal support. The positive result of the site visit committee's assessment was a primary consideration for Innovation and Science, as the review confirmed that renewal of the BIRS initiative strongly aligns with our focus on building and sustaining research capacity in areas of strategic priority. The review of past achievements also attests to the successes that resulted from Alberta's initial investment in the BIRS initiative.

In light of these points, it is my pleasure to announce that the Banff International Research Station will receive $3,325,000 between 2006 and 2010 to facilitate BIRS' future operational plans and activities. The BIRS initiative promises to continue being a significant factor in building excellent research capacity in Alberta.

I want to take this opportunity to congratulate the Pacific Institute for the Mathematical Sciences and its mathematical colleagues on the accomplishments of BIRS to date and the planned future activities. The Government of Alberta is dedicated to building research excellence in Alberta and we believe that this provincial support for BIRS will be an important factor in this regard.

Staff from my department will be contacting you regarding the conditions of funding and related next steps regarding the grant agreement for your reward.

I wish you and your BIRS' colleagues success with this important initiative.

Yours truly,

Victor Doerksen, F.C.G.A.

BIRS hosts Heads of G8 Research Councils

Contributed by Nassif Ghoussoub, Scientific Director, BIRS

Nassif Ghoussoub (Scientific Director, BIRS), Tom Brzustowski (President, NSERC), Arden Bement (Director, NSF) and Arvind Gupta (Scientific Director, MITACS). Photo by David Eisenbud (MSRI).

On May 16, 2005, the President of NSERC, Tom Brzustowski and the President of the Canadian NRC (National Research Council) Pierre Coulombe hosted a reception at BIRS in honour of their counterpart, Heads of the Research Councils in the G8 countries: USA, UK, France, Germany (DFG & Max Planck), Japan, Italy and Russia.

Representing the USA was Dr. Arden Bement, the Director of the National Science Foundation which is a major sponsor of the Banff International Research Station. Also present were Ernst-Ludwig Winnacker for Germany, Fabio Pistella for Italy, Motoyuki Ono for Japan, Vladislav Yu. Khomich for Russia, and John O'Reilly for the UK.

The G8 heads of research councils particularly enjoyed meeting their fellow countrymen among the forty participants in the BIRS workshop *Densest Packings of Spheres* who were also invited to the reception, a highlight of which was a presentation by Thomas Hales of his solution of the 400 year old Kepler problem. Particularly entertaining was the magic show of Peter Winkler who challenged the audience with one of his familiar combinatorial-geometrical puzzles. The G8 heads of research councils were later joined for dinner by the Scientific Directors of BIRS (Nassif Ghoussoub) and MITACS (Arvind Gupta), the Directors of the CRM (François Lalonde), IPAM (Mark Green), MSRI (David Eisenbud) and PIMS (Ivar Ekeland), as well as William Rundell, Director of the Division for the Mathematical Sciences at the NSF.

To view The Welcoming Remarks by BIRS Scientific Director, Nassif Ghoussoub, please consult the link at **http://www.pims.math.ca/The_News/ Latest_News/BIRS_ hosts_Heads_of_G8_Research_Councils/**.

Mexico: A Full Partner in BIRS

Contributed by Nassif Ghoussoub, Scientific Director, BIRS

It is a great pleasure to announce that CONACYT (National Council for Science and Technology of Mexico) is joining Canada's NSERC, the US National Science Foundation, and the Alberta Science Research Authority in sponsoring and funding the Banff International Research Station (BIRS) making it a truly North American collaborative project.

We welcome Dr. Jose Antonio de la Peña (Director of the Instituto de Matematicas at UNAM and former President of the Mexican Academy of Sciences) to the scientific leadership of BIRS. His role in arranging, coordinating, and participating in the visit of Ivar Ekeland (PIMS Director), Arvind Gupta (MITACS Scientific Director) and myself as BIRS Scientific Director, with Mexican scientific leadership, UNAM senior officials and the Director General of CONACYT was crucial to the success of this groundbreaking initiative. Needless to say, we are thrilled by this development as we believe it to be a first step towards a major new era for collaborative research in the mathematical sciences in North America.

An Interview with Brian Russell, New Chair of the PIMS Board of Directors

Dr. Russell, please tell us about your career and your relationship with mathematics.

I received my first degree in physics from the University of Saskatchewan in 1972, and then spent two years in Zambia teaching high school physics and mathematics at Kenneth Kuanda Secondary School, under the auspices of CUSO. When I returned to Canada I decided to switch into geophysics, so I spent another year at the U of S finishing an honours course in geophysics. I then joined Chevron in Calgary as a seismic interpreter and spent several years looking for oil and gas in Western Canada. I took a leave of absence to complete a M.Sc. in geophysics at the University of Durham in England, and then returned to Chevron and spent several more years doing seismic research in both Calgary and Houston before joining Veritas Seismic in 1982. At Veritas, I met Dan Hampson, who was then Manager of Research, and formed what was to become a very fruitful technical and business relationship. In 1987, Dan and I left Veritas to form a geophysical software company called (you guessed it!) Hampson-Russell Software Ltd., which grew from an initial staff of 4 to our current staff of over 50. Over the years, Hampson-Russell has developed a number of seismic inversion programmes which have been purchased by virtually every major oil and gas company in the world, and we continue to enhance these programmes and develop new ones. In 2002, Hampson-Russell was purchased by VeritasDGC and we have therefore come full circle! Hampson-Russell is still operated as an independent operation within VeritasDGC, and Dan and I are still fully involved in day-to-day operations. Along the way I have been very involved with geophysical societies, and have been President of both the Canadian Society of Exploration Geophysicists (CSEG) and the international Society of Exploration Geophysicists (SEG). I also finished my Ph.D. at the University of Calgary last year, and have recently been appointed as an Adjunct Professor in the Geology and Geophysics department at the U of C.

Concerning my relationship with mathematics, it has become increasingly clear to me how lucky I was to have taken all those math courses as a physics undergraduate. The complexities of seismic inversion can only be understood and implemented on a computer if you have a solid grasp of applied mathematics. My Ph.D. thesis was based on the application of multivariate statistics and neural networks to exploration seismology, and this introduced me to several new areas of applied mathematics that I found fascinating. Although I have a wide range of interests outside of geophysics and mathematics (from golf to guitar), I often enjoy cracking open books such as those by Gilbert Strang to help broaden my knowledge of applied mathematics.

When did you first hear about PIMS, and how did you begin your involvement with PIMS?

I first heard about PIMS from Professor Gary Margrave at the University of Calgary. Based on my interest in PIMS, Gary submitted my name to the board for consideration and I was very pleased to be appointed as an industry member. I am thoroughly enjoying my time on the board, both meeting new people and learning about the many activities that PIMS is involved with.

How do you view the role of mathematics within industry?

Mathematics plays a very important role within industry. I find that the deeper your understanding of the mathematics behind a physical problem, the more powerful is the solution to the problem that you are able to formulate. Many of the programmes that PIMS sponsors, such as the Industrial Problem Solving Workshop (IPSW), are showing industry how important the role of mathematics can be in their day-to-day operations. My hope is that the importance of mathematics will continue to grow within industry. And I wish that we could communicate this more clearly to the government policy makers.

This year you presented a problem at the PIMS IPSW. In your opinion, what are the benefits of such an experience?

My problem involved the prediction of oil and gas reservoir parameters using seismic data. I was also fascinated by the range of other problems that were submitted, from stock market analysis through running shoe testing to dinosaur tail mechanics! I think that the students also benefited immensely from this programme, both in their interactions with other students from around North America and the world, and from their discussions with industry representatives. It was a great experience for everyone involved.

How do you view international initiatives within the mathematics community?

The sharing of ideas within the international community has always been one the most important aspects of science and mathematics. The BIRS facility, which grew out of PIMS, has become one of the top venues in the world for the sharing of mathematical ideas. It is my hope that we continue to help this facility grow and thrive. PIMS is also looking at developing relationships with scientists and mathematicians in both South America and the Pacific Rim countries, and I look forward to being involved with these initiatives.

Mathematics education is a very important component of the PIMS mandate. What are your thoughts on this critical topic?

I am pleased with the initiatives that we have started in the area of primary education in mathematics. In particular, I feel that the work being done by Melania Alvarez-Adem to develop a pilot project for improving mathematics education at First Nations schools is getting to the very core of how we need to implement improvements in mathematics education. This is a programme that hopefully can be expanded to other parts of North America. The contributors and editors of Pi in the Sky magazine should also be complimented on their work in the area of mathematics education.

Finally, while you are chair of the PIMS Board of Directors, what are your plans?

First of all, let me say how much I am enjoying working with the Directors of PIMS, Drs. Ekeland and Adem, the staff members at PIMS, and my colleagues on the PIMS Board. I think that the role of the chair is to support the Directors and staff in their initiatives and to make sure that the good word about PIMS gets out to the community at large. As I have said throughout this interview, there are a number of initiatives that PIMS is involved in that have really caught my attention. Among these are BIRS, IPSW, international cooperation and primary school education. I plan to be involved in as many of these programmes as I can, and to make sure that we secure funding from both the government and private sectors to bring these programmes to fruition. There is sometimes a view of mathematicians as people who live in their own little abstract world that is divorced from reality. I think that PIMS is doing a good job of dispelling this myth and showing both industry and the public how important mathematics is in everyday life.

Thank you Dr. Russell.

PIMS' Position on Women and Mathematics
Disseminated on January 28, 2005

One of the most severe brain drains impeding progress throughout the world, in developed and underdeveloped countries alike, is the fact that women are turning away—or are being turned away—from studies and research in science and technology. An academic authority in the United States has again raised the possibility that it may be due to "innate differences," "innate ability," or "natural ability". Such remarks simply serve to perpetuate and legitimize the exclusion of women from fields where they are sorely needed, and to deprive society of one-half of its workforce, not to mention the indignity of branding some of us as unable to understand science. They are certainly not supported by the history nor the current practice of science. Even in the most distant past, some women have been able to overcome the tremendous difficulties put in their way by a male-dominated academic world and to make their mark in history as great mathematicians. Nowadays, girls and women in schools, colleges and universities, perform at least as well as boys and men in scientific programmes, even if they are less in number. We at PIMS are determined to increase the presence of women in mathematics, by breaking down social stereotypes of the kind we have just heard, and by encouraging female participation in our activities. We thank our female colleagues in the mathematics departments of PIMS universities for the substantial contributions they are making to mathematics, and we hope there will be more of them in the future.

New PIMS Scientific Review Panel

On July 1, 2005 the PIMS Scientific Review Panel (SRP) started a new term.

The new members of the PIMS SRP are:

• **Alejandro Adem** (Deputy Director, PIMS) [ex-officio]
• **Anne Condon** (Computer Science, UBC)
• **Carl de Boor** (Mathematics and Computer Science, U. Wisconsin-Madison)
• **John Friedlander** (Computer and Mathematical Sciences, U. Toronto at Scarborough)
• **Nancy Reid** (Statistics, U. Toronto)
• **Donald Saari** (Mathematics and Economics, UC Irvine)
• **Tatiana Toro** (Mathematics, U. Washington)
• **Efim Zelmanov** (Mathematics, UC San Diego)

The continuing members are:

• **Ivar Ekeland** (Director, PIMS) [ex-officio]
• **David Brydges** (Mathematics, UBC)
• **Randy Goebel** (Computer Science, U. Alberta)
• **Ian F. Putnam** (Mathematics, U. Victoria)
• **Bob Russell** (Applied Mathematics, SFU)
• **Gang Tian** (Mathematics, MIT)
• **Gunther Uhlmann** (Mathematics, U. Washington)

• **Hugh Williams** (Mathematics, U. Calgary)

PIMS would like to thank the following people whose term on the PIMS SRP ended in 2005:

• **David Brillinger** (Statistics, UC Berkeley)
• **Ronald Graham** (Computer Science and Engineering, UC San Diego)
• **Elizabeth Thompson** (Statistics, U. Washington)

For biographies of the PIMS SRP please see **http://www.pims.math.ca/About_PIMS/**.

Call for Proposals
BIRS 2007 Programme

The Banff International Research Station for Mathematical Innovation and Discovery (BIRS) is now accepting proposals for its 2007 programme. Full information, guidelines, and online forms are available at the website **http://www.pims.math.ca/birs/**.

BIRS is aiming for a 48-week scientific programme in 2007. Each week, the station will be running either a full workshop (40 people for 5 days) or two half-workshops (20 people for 5 days). As usual, BIRS provides full meals, accommodation, and research facilities at no cost to the organizers and to the invited participants, in a setting conducive to research and collaboration.

The deadline for 5-day Workshop and Summer School proposals is **October 14, 2005.**

In addition BIRS will operate its Research in Teams and Focused Research Groups programmes, which allow smaller groups of researchers to get together for several weeks of uninterrupted work at the station.

October 14, 2005 is also the preferred date to apply for these programmes, however, proposals for projects involving Research in Teams or Focused Research Groups can be submitted at any time—subject to availability. They must be received at least 4 months before their requested start date.

Proposal submissions should be made using the online submission form.

New Streaming Videos

• Ben Green (Former PIMS PDF at UBC) April 27, 2004, lecture about his result, discovered with T. Tao, on *Arithmetic Progressions of Primes.*

• IAM-PIMS-MITACS Distinguished Colloquia 2004–5 (6 lectures).

• SFU Computing Science Distinguished Lecture Series 2004 (2 lectures).

• Dan Rudolph (University of Maryland), PIMS Distinguished Chair, Period of Concentration in Dynamics, lectures at the University of Victoria, October 25–28, 2004 (3 lectures).

• A multitude of lectures from BIRS workshops, plus many more coming soon.

In order to view these lectures you will need Real Player software. Please see **http://www.pims.math.ca/Publications_and_Videos/Streaming_Videos/**.

PIMS PDFs for 2005

PIMS is pleased to announce the PIMS Postdoctoral Fellows (PDFs) for 2005. The members of the review panel were Douglas Lind (UW), Ailana Fraser (UBC), Pauline van den Driessche (UVic), Rustum Choksi (SFU), Ralf Wittenberg (SFU), Sudarshan Kumar Sehgal (UA) and Michael Lamoureux (UC).

New 2005 PIMS PDFs:

Mohammad Akbar: *General Relativity.* Eric Woolgar (UA).

Joshua Buresh-Oppenheim: *Computational Complexity.* David Mitchell (SFU).

Lassina Dembélé: *Number Theory.* Clifton Cunningham (UC).

Pierpaolo Esposito: *Non-linear PDE.* Nassif Ghoussoub (UBC).

Hugh Geiger: *Inverse Problems.* Gary Margrave (UC).

Mark Hamilton: *Symplectic Geometry.* Jedrzej Sniatycki (UC).

Guangyue Han: *Coding Theory.* Brian Marcus (UBC).

Jochen Kuttler: *Algebraic Geometry.* Jim Carrell (UBC).

Matilde Lalín: *Number Theory.* David Boyd (UBC).

Ying-Fen Lin: *Analysis.* Anthony To-Ming Lau (UA).

Yongmei Liu: *Artificial Intelligence.* Eugenia Ternovska (SFU).

Iulia Pop: *Algebraic Geometry.* Arturo Pianzola (UA).

Antonio Ramírez: *Topology.* Alejandro Adem (UBC).

Christopher Sinclair: *Number Theory.* Peter Borwein (SFU) and Stephen Choi (SFU).

Pablo Spiga: *Finite Group Theory.* Joy Morris (Lethbridge).

Hsian-Hua Tseng: *Algebraic Geometry.* Jim Bryan (UBC) and Kai Behrend (UBC).

Lin Wang: *Mathematical Biology.* Pauline van den Driessche (UVic).

Gert Willems: *Robust Statistics.* Ruben Zamar (UBC) and Matias Salibian-Barrera (UBC).

2004 PIMS PDFs Renewed in 2005:

Omer Angel: *Probability.* Gordon Slade (UBC).

Wael Bahsoun: *Measurable Dynamics.* Chris Bose (UVic).

Boaz Ben-Moshe: *Computational Geometry.* Binay K. Bhattacharya (SFU).

Shlomo Hoory: *Expander Graphs.* Joel Friedman (UBC).

Antonia Kolokolova: *Computational Logic.* Eugenia Ternovska (SFU).

Youngsuk Lee: *Atmospheric Modelling.* Mary Catherine Kropinski (SFU) and David Muraki (SFU).

Wilson Lu: *Statistics.* Derek Bingham (SFU).

Mario Pineda-Krch: *Mathematical Ecology*. Michael Doebeli (UBC).

Jonathan Walgate: *Quantum Information Science.* Barry C. Sanders (UC).

Rustum Choksi New SFU Site Director. Continued from first page.

His main research interests lie in the application and development of techniques in nonlinear analysis (particularly, the calculus of variations and nonlinear PDEs) to study certain problems arising in the material sciences. His recent interests have centred on phase separation and domain formation in diblock copolymer melts and magnetic materials. He has been invited to speak on his research at conferences and institutions in Italy, Germany, Japan, the UK, as well as throughout North America.

Rustum is also a dedicated teacher. Since joining SFU in 1997, he has taught 14 different courses, and in 2003 received SFU's Faculty of Science Excellence in Teaching Award.

He takes over from Manfred Trummer who held this position from 2001–05.

Call for Nominations:

PIMS PDFs for 2006

PIMS invites nominations of outstanding young researchers in the mathematical sciences for Postdoctoral Fellowships for the year 2006–07. Candidates must be nominated by one or more scientists affiliated with PIMS or by a Department (or Departments) affiliated with PIMS. The fellowships are intended to supplement support made available through such a sponsor. The institute expects to support up to 20 fellowships tenable at any of its Canadian member universities: Simon Fraser University, the University of Alberta, the University of British Columbia, the University of Calgary, and the University of Victoria, as well as the affiliated universities: the University of Lethbridge and the University of Regina.

For the 2006–07 competition, the amount of the award is $20,000 and the sponsor(s) is (are) required to provide additional funds to finance a minimum stipend of $40,000 (including benefits).

Award decisions are made by the PIMS PDF Review Panel based on excellence of the candidate, potential for participation in PIMS programs and potential for involvement with PIMS partners. PIMS Postdoctoral Fellows will be expected to participate in all PIMS activities related to the fellow's area of expertise and will be encouraged to spend time at other sites. To ensure that PIMS Postdoctoral Fellows are able to participate fully in institute activities, they may not teach more that one single-term course per year.

Nominees must have a Ph.D. or equivalent (or expect to receive a Ph.D. by December 31, 2006) and be within three years of their Ph.D. at the time of the nomination (i.e., the candidate must have received her or his Ph.D. on or after January 1, 2003). The fellowship may be taken up at any time between April 1, 2006 and January 1, 2007. The fellowship is for one year and is renewable for at most one additional year.

Nominations must include 1) curriculum vitae, 2) statement of research interests, 3) three letters of reference (including one from a sponsoring professor), and 4) statement of anticipated support from the sponsor.

The sponsors must send the complete nomination package to:
Attn: PIMS PDF Competition
Pacific Institute for the Mathematical Sciences
1933 West Mall
University of British Columbia
Vancouver, BC V6T 1Z2
Canada
or hand deliver the package to any of the Canadian PIMS Site Offices.

Nominations must be received by **December 15, 2005**. Please see **http://www.pims.math.ca/Scientific_Programme/ P I M S _ P o s t d o c t o r a l _ F e l l o w s h i p s / Call_for_PIMS_PDF_Nominations/**.

Women (and Men) in Science: How to Ask the Wrong Questions

By Barbara Lee Keyfitz, Director of The Fields Institute for Research in Mathematical Sciences and Moores Professor of Mathematics at the University of Houston. She is currently President of the Association for Women in Mathematics.

A few months ago, Carolyn Gordon and I published an article titled "Women in Academia: Are We Asking the Right Questions" (Notices of the American Mathematical Society, Volume 51 number 7, August 2004, pages 784-786). Carolyn is a professor of mathematics at Dartmouth University and has just finished her term as president of the Association for Women in Mathematics. Our point of departure was a survey showing that, in every field of science, engineering and mathematics, women are not achieving high academic rank at the same rate they are obtaining PhD degrees. (Donna J. Nelson and Diana C. Rogers, A National Analysis of Diversity in Science and Engineering Faculties at Research Universities, Final Report. (http://www. now.org/ issues/diverse/diversity_report.pdf). The question is: Why?

In our article, we urged university faculties and administrations to re-examine the criteria they use in determining whether to grant tenure to a faculty member. We suggested that they need to ask different questions — about men as well as about women — when making decisions that will affect faculty composition (and that will affect the way our children and grandchildren experience their university education) for the next several decades.

Recent remarks by Harvard's President, Lawrence Summers, have brought this issue to public attention. His remarks, however they were intended, were heard by many to assert that biological factors, including lifestyle choices unique to women, are the reason that women are failing to make the top ranks in academia.

Summers has since apologized and the issue has since moved to another place: many people believe that President Summers was only calling for the sort of analysis that we urged, and wonder whether a scholarly researcher is again being hounded by the guardians of political correctness for asking the "wrong" question. In intellectual inquiry, can there be such a thing?

If the matter is put that way, the answer is "no". We do not encourage the thought police to monitor the curiosity and research of scholars. But some questions are more productive, more amenable to answers and more likely to move us in the right direction than others. "Why did you leave your shoes in the middle of the floor?" (after I have just tripped over them in the dark) is an example of a question that, however sincerely asked, is unlikely to elicit a useful response. The question of whether biological determinism lies behind women's scoring differences on SAT mathematics tests (as some heard President Summers to say) is the same kind of question. It has been studied many times, and the results are inconclusive. The scoring differences are too slight and the results too culture-dependent to be a convincing measure of biological difference.

But suppose that women do have different abilities in mathematics. Are these distinctive talents inferior or might they instead represent a way for women to contribute uniquely to the advancement of the discipline? In a test designed by men, could there be categories in which women do not perform well, while the qualities that have enabled some women to excel in science and mathematics are simply overlooked by the test? Even for men, as for women, SAT tests are an indifferent predictor of success, and do not even purport to predict outstanding performance in science. In short, more study of whether, or why, girls do not match top-scoring boys on standardized tests is not likely to help us understand gender distribution in university faculties.

Today's society needs an increased supply of scientists, mathematicians and engineers to solve pressing medical problems like cancer and AIDS, to ameliorate environmental problems like global warming and pollution, and to continue the stream of technological innovation needed to improve the quality of life for a growing population. Universities have a unique responsibility in educating the next generation of scientists and in encouraging the research that will solve problems and generate new inventions. No academic questions are "wrong", morally, but, in a world stressed by immediate problems of environmental hazard and disease, some questions are just not worth asking.

Given that so little is known of how to predict a successful career in science, mathematics or engineering, decisions about hiring or giving tenure to university scientists have to be posed in the language of risk-assessment. Risk-averse administrations adopt the conservative strategy of hiring people who look like the people already there. But there are risk factors in hiring men as well as women (women have babies, men may have more health problems in mid life), and predictions of success in men are notoriously inaccurate.

Barbara Lee Keyfitz.

If women's talents are different, then it is possible that there are women who can make unique contributions, at the very highest level, to the scientific enterprise. But we are not going to be able to identify those women unless we ask the right questions. Institutions must develop workable, imaginative strategies to recruit and retain the best minds to address today's research and practical challenges. We need to invite the most talented women in science, at every level from postdoctoral fellow to distinguished professor, to participate in our universities. We need to make visible, to celebrate, models of success in women scientists. We need to observe that they may not have been identified by the usual predictors, and that they may not have achieved success early in life. They may, like men, have been able to combine scientific success with personal fulfillment, or, also like men, they may have struggled with adversity and have been forced to make difficult decisions.

The choice of a career is a difficult and important question for a young person. One can ask if it is easier for men than for women to make the sacrifices required for an outstanding career in science. But that avoids the question of what sacrifices are truly necessary for success. The sad fact is that in the developed world (the G-8 countries, say), the prospect of a career in science or mathematics has become so unappealing to our young people that we rely on immigration to fill our needs in research and technology. Why are so many of our brightest children not choosing careers in mathematics and science? The current attention to women in science may have the beneficial effect of drawing attention to the amount of encouragement that everyone needs to pursue this rewarding, yet demanding career.

And about those shoes. It is easy to trip each other up, intentionally or inadvertently. The right question is how to recognize each other as members of the same community, using our diverse talents for the common good.
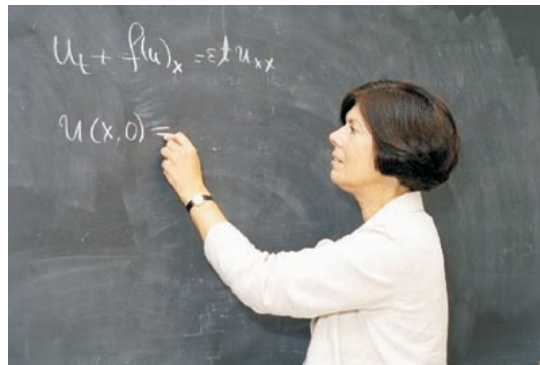
Computation at the Heart of Mathematics:
Celebrating the Work of David Boyd, Recipient of the 2005 CRM-Fields Prize

By Andrew Granville, Université de Montréal

One of the great themes of modern number theory is how analysis and algebra often give us the same information by somewhat different means, for example by a formula with an algebraic interpretation on one side and an analytic interpretation on the other.[1] There is one such formula that every mathematician has been exposed to in their education, but has only recently been seriously interpreted in this way, and that is Jensen's theorem in complex analysis. This theorem tells us that for a function f which is analytic on a closed disk of radius r, the average value of $\log |f(z)|$ on the boundary of the disk can be determined precisely in terms of $f(0)$ and the zeros of f inside the disk. In the particular case of an irreducible polynomial f with leading coefficient a_0, and the unit disk, this leads to the formula

$$M(f) := |a_0| \prod_{\alpha : f(\alpha) = 0} \max\{1, |\alpha|\} = \exp\left(\int_0^1 \log |f(e^{2i\pi\theta})| d\theta\right).$$

There are a host of results which show that this *Mahler measure* is "natural", and there are several intriguing open questions. Foremost is Lehmer's 1934 conjecture suggesting that $M(f) \geq 1 + \delta$ for some fixed $\delta > 0$ for any polynomial $f(x) \in \mathbb{Z}[x]$ other than x and the cyclotomic polynomials; in fact computational evidence suggests that the lower bound is given by $x^{10} + x^9 - x^7 - x^6 - x^5 - x^4 - x^3 + x + 1$. Much of this evidence has been given by Boyd and his collaborators who have also settled certain special cases of Lehmer's conjecture (most notably, Smyth showed that it is true for non-reciprocal polynomials). There are certain special classes of numbers that one expects to have particularly small measure, for example Pisot numbers, which are real algebraic integers greater than 1, all of whose conjugates have absolute value less than 1, and Salem numbers, where the conjugates all have absolute value less than *or equal to* 1. Boyd's nicest work in this area was to show that Salem's construction of Salem numbers does in fact give them all [5], as well as his understanding of Pisot numbers in the neighbourhood of a limit point [6]. I should also mention his 1977 result that there are Pisot sequences which satisfy no linear recurrence [4]. Lehmer's conjecture has recently been surveyed in this newsletter by Whaler [14].

One can generalize the notion of Mahler measure to multivariable polynomials, so that for $P \in \mathbb{Z}[x_1, \ldots, x_n]$ we define

$$m(P) = \int_0^1 \cdots \int_0^1 \log |P(e^{2i\pi\theta_1}, \ldots, e^{2i\pi\theta_n})| d\theta_1 \ldots d\theta_n,$$

(note that $m(f) = \log M(f)$ when $n = 1$). We think of this as an integral on the n-dimensional torus $(\mathbb{R}/\mathbb{Z})^n$, where the co-ordinates vary independently. Boyd recognized that one can approximate the co-ordinates varying independently by replacing each θ_i by a suitable multiple of θ; in particular $m(1 + x + y) = \lim_{n \to \infty} m(1 + x + x^n)$. In 1981 Chris Smyth observed that the value of $m(1 + x + y)$ is quite extraordinary; it is not some arbitrary real number, nor is it the product of the roots of some polynomial like in 1-dimension, but rather $m(1 + x + y)$ is the value of

an L-function at a particular point, specifically $L'(1, (-3/.))$. This one example inspired a host of questions about the values of $m(P)$; for example, if we replace 3 by any other prime $\equiv -1 \pmod 4$, can one find P that yields an analogous formula? Or are there extensions of this to other types of characters and zeta functions? There are a few direct generalizations proven (mostly by Ray, and by Boyd and Rodriguez-Villegas) but a lot still remains mysterious. For a long while Smyth and Ray's results had remained splendid but seemingly ad hoc, in that no one had discovered why there should be such results.

Motives have been one of the great generalizations of modern arithmetic geometry, and they showed much early promise of providing a more complete understanding of key concepts, yet arguably have failed to deliver as much as had been hoped for. However it was in Deninger's research in this area that he developed the first viewpoint to account for these special Mahler measure values. His original work did not easily yield new examples, but it did tell one how to look and in a new way. In particular he predicted that there should be various $P \in \mathbb{Z}[x, y]$ with $m(P) = rL'(E, 0)$ for some non-zero rational number r, where E is the (elliptic) curve determined by the equation $P(x, y) = 0$. Following Deninger's lead, Boyd did a vast amount of calculations to find many examples (in his paper he gives these examples with, in each case, r a rational with small numerator and denominator, with the identity confirmed up to 24 decimal places!). Boyd determined under what conditions P should be expected to satisfy a relation $m(P) = rL'(E, 0)$:[2] the outcome is uncanny in that it seems tailor-made for subsequent researchers to be able to use (well-known) conjectures of Bloch–Beilinson to predict relations of this form (and sometimes prove them). His work [9] on this is an astonishing blend of experimentation and intuition.

Fernando Rodriguez-Villegas proved several of the formulas in Boyd's paper, and then together they have a couple of important papers. The first [12] is perhaps the ultimate generalization of Chris Smyth's result about $m(1 + x + y)$, though it barely scratches the surface of what they have proved (see [13]). The value $L'(1, (-3/.))$ and appropriate generalizations appear as the volume of a hyperbolic manifold, the upper half space of hyperbolic 3-space, modulo certain discrete, torsion-free subgroups of $PSL(2, \mathbb{C})$. Such hyperbolic manifolds can be decomposed as a sum of "ideal" tetrahedra whose volumes can each be given by the Bloch-Wigner dilogarithm function evaluated at a certain point, a connection used by Thurston and then Neumann-Zagier in their work on Dehn surgery.

The A-polynomial is a remarkable invariant of a one-cusped hyperbolic 3-manifold whose zero locus basically describes the representations of its fundamental group into $SL(2, \mathbb{C})$. Manipulating the above construction appropriately, Boyd showed how the Mahler measure of any irreducible factor of A is given by a sum of Bloch-Wigner dilogarithm values, a remarkable result (see [10, 11]). Although notoriously difficult to compute, Boyd has come up with new ways to determine the A-polynomial

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[1] For examples, we see this in the Birch-Swinnerton Dyer conjecture, the Tate and Stark conjectures, in Wiles' proof of the Fermat's Last Theorem, at the heart of the Langlands' program, . . .

[2] He also allows P to define a genus 2 curve whose Jacobian splits into two factors, one of which is E.

in certain special but important cases leading him to some beautiful new results (for example for the A-polynomial of periodic knots) discovered, of course, experimentally. Understanding these connections has obsessed David over the last decade; he tells me that he has twenty-seven 192 page notebooks of computations (and their interpretation)!

Boyd has an extraordinary breadth of mathematical interests, making important contributions to areas of analysis, number theory, and geometry. Some of his earliest papers were on packings: In 1973 he showed [3] that the Hausdorff dimension of the residual set of the Apollonian packing is exactly the same as the exponent of convergence, a result that has been quite influential recently. Likewise, Boyd's results [1, 2] on higher dimensional packings were a little ahead of their time and were not followed up by others until very recently. I particularly like a more recent result that came out of understanding a question on the heights of factors of polynomials which has practical applications to symbolic computation: Given a polynomial $f(x) \in \mathbb{Z}[x]$ of degree n, provide a good bound for the size of the coefficients of any possible factor g of f. That the (mean square of the) coefficients of g is $\leq 2^n$ times that of f is easy, and 2 had been replaced by $(1 + \sqrt{5})/2$ in the literature; what Boyd did was to find the best possible constant [7], which *of course* turned out to be the Mahler measure of some two-variable polynomial! Such questions were at the time also of importance in "effective nullstellensatz" and Boyd produced a string of important results (eg. [8]).

Canada has a proud tradition of experimental mathematicians using great ingenuity, tenacity and stamina to extract deep insights from data (John McKay, who won this award in 2003, is another example). Often the final published work does not adequately reflect the difficulty of producing the data, nor how much is learnt in the process, though experts in the field appreciate the difference made. In the case of David Boyd's work one sees, time and again, that he has made valuable insights aided by extensive computation, creating new research themes which are subsequently developed internationally, so that he is a worthy laureate of the 2005 CRM-Fields prize.

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[14] Jeff D. Vaaler, PIMS magazine, vol 7, no 2, Fall 2003, pages 30–34.

Call for Nominations: 2006 CRM–Fields–PIMS Prize

The Centre de Recherches Mathématiques (CRM), the Fields Institute, and PIMS invite nominations for the joint CRM–Fields–PIMS Prize, in recognition of exceptional research achievement in the mathematical sciences. The candidate's research should have been conducted primarily in Canada or in affiliation with a Canadian university. The prize was established as the CRM-Fields prize in 1994. Renamed in 2005, the 2006 and later prizes will be awarded jointly by all three institutes. Previous recipients are H.S.M. Coxeter, George A. Elliott, James Arthur, Robert Moody, Stephen A. Cook, Israel Michael Sigal, William T. Tutte, John Friedlander, John McKay, Edwin Perkins, Donald Dawson, and David Boyd.

The selection committee struck by the three institutes will select a recipient for the 2006 prize on the basis of outstanding contributions to the advancement of the mathematical sciences, with excellence in research as the main selection criterion.

A monetary prize will be awarded and the recipient will be asked to present a lecture at each of CRM, the Fields Institute, and PIMS.

Nominations should be submitted by October 1, 2005 by at least two sponsors of recognized stature, and should include the following elements: 2 supporting letters, curriculum vitae, list of publications, and up to four preprints. During any academic year, at most one prize will be awarded.

Submit nominations to:

directeur@CRM.UMontreal.CA
Directeur, Centre de recherches mathématiques
Universite de Montreal
C.P. 6128, Succ. centre-ville
Montreal QC H3C 3J7
Canada

PIMS Scientists Receive Honours

Mathematics, SFU

Veso Jungic received an SFU Faculty of Science Teaching Award.

Adam Oberman was shortlisted for the 2005 Leslie Fox Prize for the second time in a row.

Bob Russell received the CAIMS Research Prize at the joint CAIMS–CMS Summer Meeting in Halifax in June 2004.

For more information about SFU awards see **http://www.math.sfu.ca/about/news/**.

Mathematics, UBC

Martin Barlow has been elected as a Fellow of the Royal Society (London).

Kai Behrend and **Joel Friedman** were awarded 2005 Killam Research Fellowships.

Michael Bennett won the Ribenboim Prize of the Canadian Number Theory Association.

George Bluman won the UBC Faculty of Science Achievement Award for service to UBC, in particular for promoting mathematics outreach to schools and for service as head of the Mathematics Department.

David Boyd was awarded the 2005 CRM–Fields Prize.

Michael Doebeli has been awarded the 2005 UBC Charles A. McDowell Award for Excellence in Research, and the 2005 NSERC Steacie Fellowship.

Alexander Holroyd is the co-winner with Itai Benjamini (Weizmann Institute) of the 2004 Rollo Davidson Prize.

Vlada Limic has been awarded a Sloan Research Fellowship.

Gordon Slade was awarded a 2005 Killam Research Prize.

Stephanie van Willigenburg won an Early Career Progress Award from the Peter Wall Institute for Advanced Studies.

Vinayak (Nike) Vatsal has been accorded the special honour of being invited to give a lecture at the 2006 International Congress of Mathematicians in Madrid, Spain.

For more information and a full list of awards see **http://www.math.ubc.ca/Dept/Awards/**.

Mathematical and Statistical Sciences, U. Alberta

John Bowman has been awarded a Delta Chi Fraternity Teaching Award.

K. C. Carrière has been awarded an Alberta Heritage Foundation for Medical Research Health Science Award for 5 years starting July 1, 2005.

Gerda de Vries is the winner of the 2004–05 Faculty of Science Award for Excellent Teaching.

Terry Gannon has been awarded a Humboldt Research Fellowship (for 40 and under) at the University of Hamburg.

Sam Shen has been awarded the McCalla Professorship 2005–06.

Mazi Shirvani is the winner of this year's U. Alberta Rutherford Award for Excellence in Undergraduate Teaching. This is the most prestigious teaching award given by the university.

Doug Wiens was elected a Fellow of the American Statistical Association.

Mathematics and Statistics, U. Calgary

Christiane Lemieux and Josef Dick (U. New South Wales) have been awarded the second Information-Based Complexity Young Researcher Award.

Mathematics and Statistics, U. Victoria

David Leeming received a 2005 PIMS Education Prize.

Hari M. Srivastava was honoured on his 65th birthday with the International Symposium on Analytic Function Theory, Fractional Calculus and Their Applications. PIMS was a cosponsor of this event.

Pauline van den Driessche won the Tenth Bellman Prize from the journal Mathematical Biosciences for the best paper published in the journal over the two-year period from 2002–2003. She shares the award with her co-author, James Watmough who was a PDF at U. Victoria at the time.

Mathematics, U. Washington

The **Department of Mathematics** was selected to receive the 2005 Brotman Award for Instructional Excellence. The Brotman Award is the University's undergraduate teaching excellence award for departments and other instructional units.

Charles Doran and **Isabella Novik** both received a Faculty Excellence Award for 2005–06 from the Math department at UW.

Branko Grünbaum was awarded the 2005 AMS Leroy P. Steele Prize for Mathematical Exposition. Presented annually by the AMS, the Steele Prize is one of the highest distinctions in mathematics.

Jim Morrow received two awards, a 2005 PIMS Education Prize, and a 2005–06 College of Arts and Sciences Professorship.

For more information see **http://www.math.washington.edu/**.

There was an error in the print version of the PIMS Magazine Vol 8.1. On page 10 towards the bottom of the first column, it should read "a number with approximately $1/3 \times 2^{2^{2^{2^{2^{2^{100k}}}}}}$ digits".

New UBC/SFU Joint Seminars in Statistics

Contributed by Rachel Altman, SFU

On January 27, UBC and SFU (with the support of PIMS) launched a new seminar series, entitled *UBC/SFU Joint Seminars in Statistics*.

The goal of this new seminar series is to help in creating a cohesive community of statisticians in the GVRD, and, in particular, to increase the interaction among faculty and students at UBC and SFU. The seminars are intended to be informal, and at a level accessible to graduate students. By bringing statisticians together—both from the two departments and the local medical research centres—it is hoped that the wealth of available resources within the community will be highlighted and made more accessible.

The topic of the first seminar was *Spatial Statistics*. The speakers were **Jim Zidek** (UBC), **Charmaine Dean** (SFU), and her graduate student, **Farouk Nathoo** (SFU). Dr. Zidek discussed the subject of combining information from physical and statistical models for spatial processes such as air pollution. He focused on a Bayesian melding approach for predicting ozone levels at points on a grid. Dr. Dean and Mr. Nathoo spoke about multistate models for data with both temporal and spatial components. Their work has application, for example, in the monitoring of disease over time within a given region.

On October 6 the second seminar in the series will be held. It will be on *Topics in Bayesian Statistics*. The speakers will be **Paul Gustafson** (UBC) and **Tim Swartz** (SFU).

For more information about this seminar series, please contact **Rachel Altman** (raltman@stat.sfu.ca) or **Jason Loeppky** (jason@stat.ubc.ca).

Rachel Altman (SFU) and Jason Loeppky (UBC).

Upcoming Activities

Pacific Rim Mathematical Forum
BIRS, October 13–16, 2005

The Mathematical Sciences Research Institute (MSRI, Berkeley) and PIMS are co-organizing the Pacific Rim Mathematical Forum in Banff during the days of October 13–16, 2005.

The main objective of this meeting will be to form a cohesive network of mathematical centres in the Pacific Rim, with the goal of laying the groundwork for substantial networking activities involving North American institutions and universities.

The meeting will involve a number of activities, including mathematical presentations, round tables and wide ranging discussions. The goal will be to exchange points of view and information in order to develop a blueprint for comprehensive interactions between Pacific Rim mathematicians.

On October 17 a mini-symposium will be held at the PIMS Central/UBC Office with faculty from UBC and other nearby universities. Participants of the BIRS workshop are also invited to this meeting. It will provide an opportunity for these participants to meet with colleagues in Vancouver, and to see first-hand how their institution would benefit from the networking framework discussed in Banff.

Stringy Topology in Morelia
Morelia, Mexico, January 9–20, 2006

This MSRI conference is being organized by **R. Cohen** (Stanford), **J. Morava** (Johns Hopkins), **A. Adem** (UBC) and **Y. Ruan** (UW-Madison). The local organizers are **M. Aguilar** (UNAM-Mexico City), **D. Juan-Pineda** (UNAM-Morelia) and **J. Seade** (UNAM-Cuernavaca).

The introductory lecturers are **E. Lupercio** (CINVESTAV) and **B. Uribe** (U. Andes).

New ideas in string theory, in particular D-branes and their relevance to open strings, have in many ways revolutionized modern quantum field

MSRI
Mathematical Sciences Research Institute

theory, but this subject is currently highly heuristic: its formalization and mathematical development has barely begun. The geometric naturality and flexibility of these concepts has fostered rapid development, but their codification is completely open. Orbifolds, gerbes, and stacks are all topics with well-established classical literatures, but the idea that they should be grouped together, and that the various kinds of twistings they manifest are relevant to physics, is a new idea in mathematics.

The central purpose of this two-week programme in Morelia is to introduce these concepts to young research mathematicians from both South and North America. The introductory lectures will provide the necessary background; these will be supplemented, primarily during the last week, with lectures on recent progress by leading researchers. We anticipate funding from the National Science Foundation, through its Pan-American Advanced Studies Institutes Program.

Registration is free and remains open until one week before the workshop. Limited funding is available; students, recent Ph.D.s, women and minorities are particularly encouraged to apply.

Support for travel of Canadian participants is being provided by PIMS.

Further information and links to the workshop web page are available at: **http://www.msri.org**.

Motives and Periods
UBC, June 5–12, 2006

The conference is intended to cover recent developments in the study of motives and periods with an emphasis on the connections to physics, arithmetic and algebraic cycles. The conference has an instructional component which consists of a series of survey talks. The conference will provide an opportunity for young speakers to present their results.

The main speakers will be **Spencer Bloch** (U. Chicago), **Pierre Colmez** (U. Paris), **Kazuya Kato** (Kyoto U.) (tentative), **Dirk Kreimer** (IHES), **Marc Levine** (Northeastern U.) and **Madhav Nori** (U. Chicago).

The conference organizers are **Jim Carrell** (UBC), **James D. Lewis** (U. Alberta), **Stefan Müller-Stach** (Universität Mainz), **Andreas Rosenschon** (U. Buffalo) and **Pramath Sastry**

(U. Toronto).

This workshop is an activity of the PIMS CRG on Algebraic Geometry, Group Cohomology, and Representation Theory.

For more information please see **http://www.pims.math.ca/science/2006/06motives/**.

The UBC rose garden. The image is from the Motives and Periods poster. Photo taken by Misha Bawa.

Canadian Number Theory Association IX Meeting
UBC, July 9–14, 2006

The Canadian Number Theory Association (CNTA) was founded in 1987 at the International Number Theory Conference at Laval University. The purpose of the CNTA is to enhance and promote learning and research in Number Theory, particularly in Canada. To advance these goals the CNTA organizes major international conferences, with the aim of exposing Canadian students and researchers to the latest developments in number theory.

The 2006 conference is being organized by **Michael Bennett** (UBC), **Nils Bruin** (SFU), **Stephen Choi** (SFU) and **Vinayak Vatsal** (UBC).

The plenary speakers are **F. Beukers** (Utrecht), **M. Bhargava** (Princeton), **H. Cohen** (Bordeaux), **B. Conrad** (Michigan), **J. Friedlander** (Toronto), **J. Lagarias** (Michigan), **C. Pomerance** (Dartmouth), **B. Poonen** (Berkeley), **K. Rubin** (UC Irvine), **P. Sarnak** (Princeton), **C. Skinner** (Michigan), **K. Soundarajan** (Michigan), **W. Stein** (UC San Diego), **T. Tao** (UCLA) and **M. Waldschmidt** (Jussieu).

The conference will include the following special sessions: *Algebraic Number Theory* (Organizer: Nike Vatsal), *Analytic Number Theory*

An Inukshuk viewed from downtown Vancouver. The image from the Canadian Number Theory Association IX Meeting poster.

(Organizer: Greg Martin), *Arithmetic Algebraic Geometry* (Organizer: Imin Chen), *Computational Number Theory* (Organizer: Nils Bruin) and *Diophantine Analysis and Approximation* (Organizer: Michael Bennett).

Before May 1, 2006, the registration fees are as follows: Faculty with Grants $250, Faculty without grants and PDFs $125 and Students $75. On or after May 1, 2006, it is: Faculty with Grants $325, Faculty without grants and PDFs $150, Students $100 and Special Session Speaker/Organizer $125. Online registration closes May 1, 2006. On-site registration will be available at the event.

For more information please see **www.pims.math.ca/science/2006/06cnta**.

Applied Inverse Problems 2007
UBC, July, 2007

The 4th Applied Inverse Problems (AIP) conference will be held in Vancouver for one week in July of 2007.

The enormous increase in computing power and the development of powerful algorithms has made it possible to apply the techniques of Inverse Problems to real-world problems of growing complexity. Applications include a number of medical as well as other imaging techniques, location of oil and mineral deposits in the earth's substructure, creation of astrophysical images from telescope data, finding cracks and interfaces within materials, shape optimization, model identification in growth processes and, more recently, modelling in the life sciences.

The series of AIP Conferences aim to provide a primary international forum for academic and industrial researchers working on all aspects of inverse problems, such as mathematical modelling, functional analytic methods, computational approaches, numerical algorithms etc.

The success of the first conference in Montecatini in 2001 with more than 150 participants and several parallel sessions led to the proposal to have this conference every two years, alternating between North or South America and Europe or a site outside the western hemisphere. A second equally successful conference was thus held in Lake Arrowhead, California in 2003 and a third was held in Cirencester in the UK Cotswold region from June 26–30 in 2005.

Each AIP conference will follow the pattern of a number of invited talks from international experts and a set of minisymposia on topical themes. The venues have been chosen to encourage the maximum interaction between all participants. The Vancouver conference will have in excess of 150 participants.

The main organizers are **Gary Margrave** (U. Calgary), **Richard Froese** (UBC) and **Gunther Uhlmann** (U. Washington).

The local organizing committee is **Uri Ascher**, **Michael Bostock**, **Anna Celler**, **Joel Feldman** and **Felix Herrmann**.

The steering committee consists of **Mario Bertero** (U. Genova, Italy), **Michael Lamoureux** (U. Calgary), **Joyce McLaughlin** (RPI), **Adrian Nachman** (U. Toronto), **William Rundell** (NSF and Texas A&M), **Erkki Somersalo** (Helsinki Institute of Technology) and **Michael Vogelius** (Rutgers).

This conference is an activity of the PIMS CRG on Inverse Problems.

For details on previous workshops and more information see the web page: **http://aip.disi.unige.it**.

AMS Western Section Meeting
UBC, October 4–5, 2008

PIMS and the Mathematics Department at UBC will be co-hosting the American Mathematical Society (AMS) Western Section Meeting in 2008.

It will be the first meeting of the Western Section ever held in Canada (at least over the last thirty years, which is as far as the AMS staff could verify).

Michel Lapidus is the Western Section Secretary for the AMS.

For more information see **http://www.ams.org/amsmtgs/sectional.html**.

PIMS/Shell Lunchbox Lectures, Calgary

October 13, 2005
Mark Bauer (Mathematics & Statistics): *Elliptic Curve Cryptography*

November 10, 2005
David Keith (Chemical and Petroleum Engineering, Schulich School of Engineering): *Fossil Fuels Without Emissions: Managing the Risks of Underground CO_2 Storage*

December 6, 2005
Ian Gates (Chemical and Petroleum Engineering, Schulich School of Engineering): *On the Operating Strategy in Solvent-Aided Steam-Assisted Gravity Drainage*

December 20, 2005
Larry Bates (Mathematics & Statistics): *Spinning Tops*

IAM-PIMS-MITACS Distinguished Colloquium Series, UBC

September 26, 2005
Eli Tziperman (Harvard): *Rapid Past Climate Change: It's the Sea Ice*

October 17, 2005
Eitan Tadmor (U. Maryland): *Edge Detection, Hierarchical Decompositions and Velocity Averaging*

November 7, 2005
Gregory Kriegsmann (NJIT): *Microwave Heating of Materials: A Mathematical and Physical Overview*

January 16, 2006
Lakshminarayanan Mahadevan (Harvard): *Geometry and Elasticity in Physical Packing Problems*

March 20, 2006
Philip Holmes (Princeton): *Optimal Decisions in the Brain: From Neural Oscillators to Stochastic Differential Equations*

March 27, 2006
John Tyson (Virginia Tech): *Computational Cell Biology: From Molecular Networks to Cell Physiology*

PIMS-MITACS Adaptivity and Beyond:
Computational Methods for Solving Differential Equations
Celebrating the 60th birthday of Robert D. Russell

Pan Pacific Hotel, Vancouver, August 3–6, 2005

Contributed by Manfred Trummer, Simon Fraser University

Ms. Barbara Charlie (Elder of the Squamish Nation) opening the conference.

The main theme of this conference was adaptive computational methods for differential equations. Adaptation has now become fundamental to the numerical solution of differential equations: accuracy and efficiency can be gained by adapting the computation to the physical solution or important properties of the equation to be solved. Over the last three decades, adaptive computation has established itself as an area of intensive research activities driven by ever more challenging applications. It is a rapidly changing area and one in need of development of even more robust and reliable strategies and better understanding of the basic principles behind them. Bob Russell has made many groundbreaking contributions to the field, and it was a special privilege to dedicate this conference to Dr. Russell in celebration of his 60th birthday.

Bob Russell received his Ph.D. in 1971 at the University of New Mexico under the direction of Lawrence Shampine. In 1971 he became Assistant Professor at Colorado State University and in 1972 he moved to Simon Fraser University. He was promoted to Full Professor in 1981. He has held numerous visiting positions throughout the world, including Stanford, Uni-

versity of Auckland and Imperial College (as an SERC Fellow). Russell's travels include visits as an Invited Scholar at the USSR and Chinese Academies of Science and as a plenary speaker at SIAM's Dynamical Systems Conference in 2000. His journal editorships have included SIAM Journal on Numerical Analysis and SIAM Journal for Scientific Computing. He is a founding member and past Vice President of CAIMS (Canadian Applied and Industrial Mathematics Society), has served two terms on NSERC's Grant Selection Committee in Computer Science, is on IMACS Board of Directors, and is a Canadian representative for ICIAM. Bob Russell was the winner of the 2004 CAIMS Research Prize.

His field of research is scientific computing, with special emphasis on the numerical solution of PDEs and ODEs. A special interest is in dynamical systems and computational methods which preserve qualitative features of solutions of differential equations. This has recently been in the context of developing mathematical software using adaptive gridding techniques.

Bob Russell has been very much involved in the governance at the university level (as a member of the SFU Senate and the SFU Board of Governors), always advocating for the fair treatment of underprivileged groups. He has also been PIMS-SFU site director, is currently the Director of the Centre for Scientific Computing at SFU, and a member of the Scientific Review Panel of PIMS.

Bob is a wonderful colleague, and a mentor to many young aspiring computational scientists. The gathering at this conference of so many outstanding researchers is a tribute to the countless contributions Bob Russell has made to his field.

Ms. Barbara Charlie, an esteemed Elder of the Squamish Nation opened the meeting with a blessing and welcoming ceremony to her traditional lands. A short slide show provided some photographic snapshots of Bob Russell's career. **Rolf Jeltsch** from the ETH Zurich delivered a special greeting address to Bob from the ICIAM Board of Directors. **Chris Budd** from the University of Bath gave a humourous yet informative opening talk entitled "*Who put the r into r-adaptivity?*" describing some of Bob Russell's many contributions to scientific computing. In
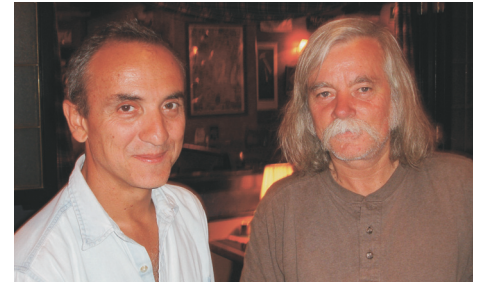
Bob Russell with his first Ph.D. student Luca Dieci (now at Georgia Tech).

total 32 talks were presented, the majority dealing with current research in "adaptivity", with a few talks in the "beyond" section. Yet even those stirred up a great deal of interest and led to interesting questions and discussions.

The conference schedule allowed a fair amount of time for informal meetings, and, of course, gave all an opportunity to celebrate Bob's birthday. Most memorable, perhaps, was our Thursday evening dinner cruise up Indian Arm, with beautiful vistas of the Vancouver area and a near picture perfect sunset behind the Lions Gate Bridge.

The Pan Pacific proved to be a spectacular venue for the meeting, and the staff at the hotel did an excellent job. The meeting was organized by the SFU PIMS site office. There were many people who contributed to the success of the meeting, and the organizers' thanks go out to all of them. Further information can be found at the conference web site **http://www.pims.math.ca/science/2005/05adaptive/.** The meeting officially concluded very much in line with Bob Russell's well known informal style: An evening at an Irish Pub in Kitsilano. Cheers to Bob!

Uri Ascher (UBC), Jan Christiansen, Bob Russell (SFU), a reunion of co-authors.
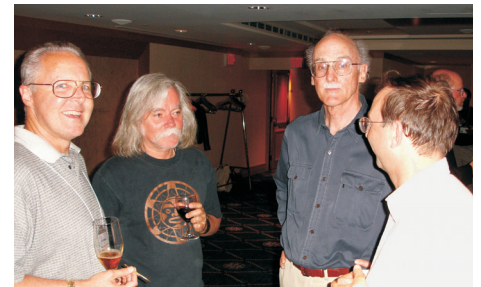
David Watkins (Washington State University), Bob Russell (SFU), Chris Paige (McGill University) and Chris Budd (University of Bath).

Foundational Methods in Computer Science
University of British Columbia, June 2–5, 2005

Contributed by John MacDonald, University of British Columbia

The Foundational Methods in Computer Science (FMCS05) workshop was an informal meeting to bring together researchers in mathematics and computer science with a focus on applications of category theory in computer science. Featured speakers included **Vaughan Pratt** (Stanford) and **Steve Bloom** (Stevens Institute of Technology) as well as **Ernie Manes** (U. Massachusetts) and **Phil Mulry** (Colgate U.).

The meeting began with a reception at 6pm in the Ruth Blair room in Walter Gage Towers on the UBC campus on Thursday June 2, 2005. This was followed by a day of tutorials aimed at students and newcomers to computer science applications of category theory, followed by a day and a half of research talks. The meeting ended at 1pm on Sunday June 5.

There were a few invited presentations, but the majority of the talks were solicited from the participants. Student participation was particularly encouraged at FMCS with several students making presentations based on their theses.

The next meeting of this workshop will be at the Kananaskis field station of the University of Calgary in June 2006. It is scheduled to return to the UBC campus in 2009.

PIMS-MITACS Stochastic Calculus and its Applications to Quantitative Finance and Electrical Engineering
University of Calgary, July 24–27, 2005

MITACS

Contributed by Robert J. Elliott, RBC Financial Group Professor of Finance, Haskayne School of Business, University of Calgary

This conference, partially funded by PIMS, was exceptionally successful.

The scientific organizer was **Paul Malcolm** (National Information and Communications Technology, Australia).

The conference opened on Sunday July 24 with two parallel series of tutorial lectures. One was given by **John van der Hoek** and **Alexei Filinkov** (both from U. Adelaide) on *fractional Brownian motion* and *white noise calculus* respectively. The other on *filtering, estimation and control* was given

John van der Hoek (U. Adelaide), Eckhard Platen (U. Technology, Sydney), Monique Jeanblanc (Université d'Evry) and Harold Kushner (Lefschetz Center for Dynamical Systems).

by **Paul Malcolm**, **Lakhdar Aggoun** (Sultan Qaboos U.) and **Charalambos Charalambous** (U. Cyprus). These tutorials had audiences of over 20 in each parallel session, including graduate students from Calgary, Edmonton, Waterloo and elsewhere.

The conference proper was opened on July 25 by **Carol Stewart** (Vice Dean, Haskayne School of Business) and **Paul Malcolm**. The opening speaker was **Dilip Madan** (Morgan Stanley and U. Maryland). The other three speakers on the opening morning were **Eckhard Platen** (U. Technology, Sydney), **John van der Hoek** and **Monique Jeanblanc** (Université d'Evry).

Monday and Tuesday afternoons were taken up with parallel finance and engineering sessions.

Tuesday morning the opening speaker was **Alain Bensoussan** (Formerly head of the French Space Agency, now at the U. Texas, Dallas) followed by **Vikram Krishnamurthy** (UBC), **Charalambos Charalambous** and **Wolfgang Runggaldier** (U. Padova, Italy).

The closing speaker on Wednesday was **Helyette Geman** (ESSEC and Universite de Paris IX).

Scientifically and socially the conference was very enjoyable. Many people said it was the best meeting they had attended.

For more information please see **http://homepages.ucalgary.ca/~rje2005/RJEProgram.html**.

Robert J. Elliott (U. Calgary).

5th Combinatorics Day
University of Lethbridge, May 20, 2005

Contributed by organizers Wolf Holzmann and Hadi Kharaghani, University of Lethbridge

This event attracted about 35 participants, with about half local, with the rest mainly from universities in Western Canada including Calgary, Alberta, Regina, Manitoba, and from Montana, USA. About half of the participants were graduate and undergraduate students.

The single day event provided a chance for researchers and others with an interest in combinatorics to meet and exchange ideas, and develop collaborative relationships.

The event included the presentation of the 2004 Hall Medal to Masaaki Harada on behalf of the ICA by Professor Ralph Stanton.

The speakers and the title of their talks were:

Masaaki Harada (Yamagata U., Japan): *A Survey of Extremal Doubly-Even Self-Dual Codes*

Steve Kirkland (U. Regina): *Aztec Diamonds and Hankel Determinants*

John W. Moon (U. Alberta): *Some Results on Distances in Trees*

More information can be found at **http://www.pims.math.ca/combday5**.

Ernie Ruet D'auteuil (ICA), Ralph Stanton (U. Manitoba), Masaaki Harada (Yamagata U.), Hadi Kharaghani (U. Lethbridge), Steve Kirkland (U. Regina) and Rob Craigen (U. Manitoba).

PIMS Collaborative Research Groups

Featured PIMS CRG: Probability and Statistical Mechanics: 2004–06

Contributed by Ed Perkins, University of British Columbia

The PIMS Collaborative Research Group in Probability and Statistical Mechanics has been active since April of 2004 and will continue through the summer of 2006. The first Summer School in Probability at UBC was held last June and featured 5 weeks of lectures by Martin Barlow (UBC) on *Random Walks and the Geometry of Graphs* and Greg Lawler (Cornell U.) on *Schramm–Loewner Evolution (SLE) and other Conformally Invariant Processes in the Plane*. The courses were attended by over 50 students roughly in equal numbers from Canada, the U.S. and Europe and were officially offered as Graduate level courses by the Department of Mathematics at UBC.

Random walks on graphs can be studied in an undergraduate level probability course. Martin Barlow's course looked at more advanced problems in this area, and reviewed approaches which have been developed in the last 20 years or so by Varopoulos, Stroock, Saloff–Coste and others. One theme of this course was the relation between geometric properties of graphs (as given for example by isoperimetric inequalities), analytic inequalities on the graph, and properties of the transition densities of the random walk.

Many of the students at the course enjoyed a short break to participate in a two day conference: *Analysis, Probability, and Logic: A Conference in Honor of Edward Nelson,* June 17–18, 2004, which was held with the generous support of NSF and PIMS. It featured review lectures on areas influenced by Nelson's seminal papers: Quantum Field Theory, Stochastic Quantum Mechanics, Logic, Nonstandard Analysis and Functional Analysis. Lectures were given by David Brydges, Sam Buss, Eric Carlen, Len

2005 Probability Summer School lecturers: Gordon Slade (UBC), Yuval Peres (Berkeley).

Gross, Greg Lawler, Barry Simon, Cedric Villani, and Jay Hook.

Many of the participating students also attended the first two of an outstanding sequence of five lectures given by Erwin Bolthausen (U. Zürich) on *Sherrington–Kirkpatrick Spin Glasses* (June 21–July 2, 2004). These lectures concerned a deep development in the physics of high dimensions where an outstanding open problem for nearly thirty years has been to prove that the ansatz for the Sherrington–Kirkpatrick (SK) model found by the Italian physicist, Giorgio Parisi, is actually the exact solution. He explained that the SK model is an instance of the classical problem of finding the maximum of a family of Gaussian random variables. Although Fernique, Talagrand and others have developed methods for handling such quantities, "these theories never give exact constants, the Parisi-theory does, revealing an absolutely marvellous mathematical structure behind the problem, which is still very poorly understood, to this day". The lectures go on to explain the rigorous work originated by Francesco Guerra which played an important role in the complete solution given recently by Michel Talagrand.

Greg Lawler's course provided a comprehensive introduction to SLE which has provided a range of conformally invariant processes in the plane which have arisen as scaling limits of loop-erased random walk, percolation on the triangular lattice and the frontier of planar Brownian motion. Thus many of the predictions made by conformal field theory in the physics literature have been rigorously proved. Self-avoiding walk has been proposed as a model for long polymer chains in chemical physics. Whether or not rescaled two-dimensional self-avoiding walk converges to SLE (8/3) remains a major open problem. The corresponding question in four dimensions, where the scaling limit is conjectured to be Brownian motion, is a problem of active current research of David Brydges and Gord Slade (UBC) and John Imbrie (Virginia). The corresponding limit in 5 or more dimensions was shown by Takashi Hara and Gord Slade to be ordinary Brownian motion using the lace expansion introduced by Brydges and Spencer. I have already described all that is known in the obviously important 3-dimensional setting. This

state of affairs has recently been replayed for critical percolation, where in dimensions greater than 6, the scaling limit appears to be a measure-valued cousin of Brownian motion, and for two dimensions the scaling limit for critical site percolation on the triangular lattice is SLE (6). These scaling limits were the focus of a 5–day workshop at BIRS, *Critical Scaling for Polymers and Percolation*, organized at the end of May 2005 by David Brydges (UBC), Jennifer Chayes (Microsoft Research) and Gordon Slade (UBC). *The Lace Expansion and its Applications* was the topic of Gord Slade's lectures in this year's Summer School (June 5–30, 2005) at UBC. The second set of lectures was given by Yuval Peres (Berkeley) on *Mixing for Markov Chains and Spin Systems*. Over 50 participants registered for these courses which are again being offered as official courses by the Math Department at UBC.

The PIMS Distinguished Chairs for 2004–05 were Richard Bass (U. Connecticut) and Yaozhong Hu (Kansas U.). Professor Bass spent a year at UBC and gave an advanced graduate course on *Probabilistic Techniques in Partial Differential Equations* in the fall term. Professor Hu is visiting the University of Alberta for most of the year and gave a series of lectures there including an open lecture on a new *Black–Scholes Type Formula for Stock Prices with Longterm Memory* that attracted over thirty-five people from diverse areas of industry and academia. Professor Bass spent a week at U. Alberta in March, 2005, and Professor Hu visited UBC in November, 2004. Nick Krylov (U. Minnesota) also visited both campuses in January and February, 2005. He spoke at UBC on his work on solutions to the heat equation with random boundaries problems and applications to stochastic PDE. One of next year's Distinguished Chairs will be Frank den Hollander (Technical University Eindhoven) who will spend January–August 2006 at UBC and give a course on *Large Deviations*. Hollander is the outgoing Director of Eurandom, a research institute in stochastics in Eindhoven, the Netherlands. He has an impressive range of interests including percolation, branching particle systems, superprocesses, and large deviations.

There has been increased involvement with U. Washington this year and it will continue next year. PIMS continues to be a joint sponsor of
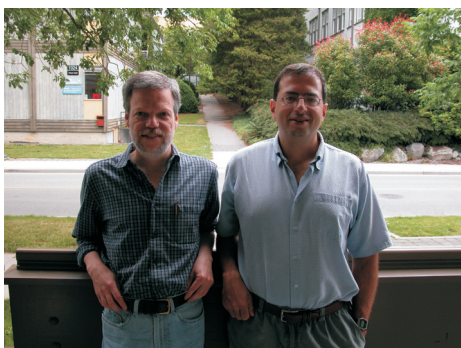
Hiking The Chief: Participants of the 2005 PIMS-MITACS Summer School in Probability.

the Pacific Northwest Probability Seminar held October 23, 2004, in Seattle as an MSRI-Network Conference. Lectures were given by Mina Ossiander (Oregon State), Rick Kenyon (UBC, new Canada Research Chair), Oded Schramm (Microsoft Research) and Ofer Zeitouni (U. Minnesota) who gave the first Birnbaum Lecture. Professor Zhenqing Chen of U. Washington visited UBC in the fall term of 2004 and worked on research projects with Martin Barlow (UBC), Richard Bass (Distinguished Chair) and Ed Perkins (UBC). Next year PIMS and the Math Department at U. Washington will sponsor a year long visit by Rami Atar (Technion) to U. Washington where he will be working with Chris Burdzy. Rami will also be visiting UBC for part of this time.

A number of visitors came to UBC this summer to participate in the summer school and an informal workshop on *Uniqueness Questions for Infinite Dimensional Diffusions*, July 4–10. The scaling limit of branching random walks, or branching random walks conditioned on constant population size converge to a Dawson–Watanabe superprocess or Fleming–Viot process, respectively. The former processes also describe the scaling limit of critical percolation in high di-

mensions mentioned earlier. In this setting the individual members of the population branch and migrate independently. In the more realistic setting where the particles interact, the corresponding limit theorem is open in general. The problem is that the limiting stochastic partial differential equation exhibits non-Lipschitz and degenerate coefficients in front of the noise and so uniqueness of solutions is unresolved. In the context of Fleming–Viot processes a fundamental paper of Don Dawson and Peter March (J. Funct. Anal. 1995) established uniqueness in the context of Fleming–Viot processes but only for small perturbations of the non-interacting case. The finite-dimensional case was in fact only recently settled in papers of Athreya, Barlow, Bass and Perkins (2003) using again a perturbative approach but now with respect to a norm which allows perturbations of arbitrary size. So far the original problem has not submitted to these advances, however. The workshop will focus on these general questions and also on particular interactive models arising naturally in predator-prey and diploid branching systems. Lorenzo Zambotti (Politecnico Milano, Italy) has done some intriguing calculations on the latter which were presented at a BIRS Workshop on *Stochastic PDEs* in 2003. Participants in this summer's Workshop included Martin Barlow, Richard Bass, Don Dawson, Jean–Francois Le Gall, Peter March, Leonid Mytnik, Ed Perkins, Yongjin Wang and Lorenzo Zambotti.

New PIMS CRGs starting Periods of Concentration

Algebraic Geometry, Group Cohomology and Representation Theory: 2005–07

Overview

Algebraic geometry is a mathematical discipline which uses the techniques and tools of algebra (e.g. rings, ideals and fields) to attack geometric problems. The fundamental objects which algebraic geometers study are algebraic varieties, the common zeros of a collection of polynomials. In the last four decades, beginning with the ground breaking work of Alexandre Grothendieck, the discipline has undergone phenomenal growth and has had a profound influence on the development of modern mathematics. Many of its celebrated works have led to Fields Medals: the proofs of the Weil Conjectures by Deligne, Mumford's work on geometric invariant theory, Hironaka's work on the resolution of singularities, Mori's work on the classification of algebraic varieties in dimension three and Wiles' proof of Fermat's Last Theorem which

used arithmetic algebraic geometry. Furthermore, the work of Kazhdan, Lusztig, Kashiwara and others has made algebraic geometry an indispensable tool for representation theory. In the last fifteen years, exciting new connections between algebraic geometry and physics emerged, which led to unexpected new mathematical theories such as mirror symmetry and quantum cohomology and to many important developments in the field of mathematical string theory.

Algebraic geometry has also given us new insight into the nature of algebraic groups and Galois cohomology. During the last two decades many exciting fundamental theorems have been established due to the introduction of new powerful techniques from algebraic topology and algebraic geometry. For instance, Voevodsky's use of homotopy and cobordism theory have resulted first in the solution of Milnor conjecture and,

more recently, the Bloch-Kato conjecture. Further development of these ideas is crucial.

This CRG has many people working at the cutting edge in several of the above areas. Among the specialties represented by our varied group are algebraic stacks, geometric invariant theory, algebraic group actions, toric varieties and torus actions, algebraic cycles, Gromov-Witten theory, arithmetic algebraic geometry, classification theory, algebraic representation theory, Lie theory and Schubert varieties, group cohomology.

The scientific activities below make up the 2005–06 PIMS Thematic Programme on Algebraic Geometry, Cohomology and Representation Theory. The CRG received additional funding for these activities. It has been said that the *2005 AMS Summer Institute in Algebraic Geometry* was the largest meeting in algebraic geometry ever. We are pleased to have hosted it at a PIMS university.

Scientific Activities

The group is associated with a large number of workshops and conferences:

April 9–10, 2005: *WAGS: Western Algebraic Geometry Seminar*, U. Washington

July 18–22, 2005: *Graduate Student Warm-Up Workshop for AMS Summer Institute in Algebraic Geometry*, Seattle
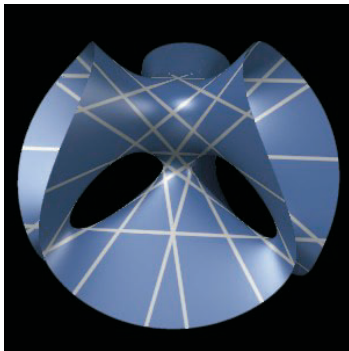
July 25–August 12, 2005: *AMS Summer Institute in Algebraic Geometry*, Seattle

June 5–12, 2006: *Motives and Periods*, UBC (for more information please see page 12)

Related BIRS Workshops

April 23–28, 2005: *Applications of Torsors to Galois Cohomology and Lie Theory*

September 10–15: 2005, *Interactions Between*

Graduate Student Warm-Up Workshop for AMS Summer Institute in Algebraic Geometry, logo.

Noncommutative Algebra and Algebraic Geometry

October 8–13, 2005: *Progress in Algebraic Geometry Inspired by Physics*

November 12–17, 2005: *Homotopy Theory and Group Actions*

December 10–15, 2005: *Regulators II*

July 1–6, 2006: *PIMS/UNAM Summer School*

July 22–27, 2006: *Moduli Spaces and Combinatorics*

September 2–7, 2006: *Algebraic Groups, Quadratic Forms and Related Topics*

Weekly Seminars

UBC Algebraic Geometry Seminar
UBC Algebra & Topology Seminar
University of Alberta Algebra Seminar

Regional Seminar

BAGS: Bellingham Algebraic Geometry Seminar. A biannual miniconference held in Bellingham with participants from UBC and UW.

PIMS Distinguished Visitor

Michael Thaddeus (Columbia) will be a long-term visitor at PIMS-UBC, September 2005–August 2006.

Faculty

CRG Leaders: Arturo Pianzola (U. Alberta), Jim Bryan (UBC)
SFU: Nils Bruin, Imin Chen
U. Alberta: Xi Chen, Gerald Cliff, Vladimir

Chernousov, Terry Gannon, Jim Lewis
UBC: Alejandro Adem, Kai Behrend, Patrick Brosnan, Jim Carrell, Bill Casselman, Kalle Karu, Dale Peterson, Zinovy Reichstein
U. Calgary: Clifton Cunningham
U. Washington: Eric Babson, Sara Billey, Chuck Doran, Amer Iqbal, Sandor Kovacs, Paul Smith, Rekha Thomas, James Zhang

Postdoctoral Fellows

Postdoctoral fellows associated with the algebraic geometry group include Jacob Shapiro (PIMS-UBC), Anca Mustata (UBC) and Andrei Mustata (UBC).

Two CRG sponsored PIMS postdoctoral fellows will join the group in the fall of 2005: Hsian-Hua Tseng at UBC and Iulia Pop at U. Alberta.

Confirmed Visitors

M. Roth (Queen's), D. Maulik (Princeton), Y. Ruan (Wisconsin), P. Gille (CNRS, Université Paris-Sud), M. S. Raghunathan (Tata Institute), I. Panin (St. Petersburg), D. Harari (ENS Paris), J. Minac (U.Western Ontario), J. Carlson (U. Georgia), S. Smith (U. Illinois, Chicago).

Opportunities

There will be additional postdoctoral fellows sponsored by the Collaborative Research Group beginning in fall of 2006. Applications should be sent to faculty members with research interests common to the applicant.

Inverse Problems: 2005–07

Overview

Inverse Problems (IP) are problems where causes for a desired or observed effect are to be determined. An important example is to determine the density distribution inside a body from measuring the attenuation of X-rays sent through this body, the problem of "X-ray tomography". The matematical problem was studied first by Radon in 1917. Much later, pioneering work by Hounsfield and Cormack led to the first working X-ray tomography machines and later to CAT scans and was honored with the Nobel Prize for Medicine in 1979. This development revolutionized the practice of medicine. Other more recent medical imaging techniques are MRI where the effect of a strong magnetic field on the body is measured, ultrasound where sound waves are sent through the body and their reflections measured, and Electrical Impedance Tomography where electrical measurements are made on the boundary of the body, to name just a few. Earth

sciences continue to be a generator of many compelling inverse problems. All of our knowledge of the Earh's interior is indirectly derived from surface measurements, as is a great deal of what we know about the surface and the atmosphere.

Reflection seismology in oil exploration is a well-known and economically important inverse problem. Here sound waves are generated at the surface of the Earth. By looking at the reflection of these waves one would like to determine the location and character of oil deposits. From an economic perspective, seismic imaging is by far the dominant geophyscial inversion technique. Seismic imaging creates images of the Earth's upper crust using seismic waves generated by artificial sources and recoreded into extensive arrays of sensors (geophones or hydrophones). The techonology is based on a complex and rapidly evolving mathematical theory that employs advanced solutions to a wave equation as tools to solve approximately the general seismic in-

verse problem. In the year 2000, nearly $4 billion was spent worldwide on seismic imaging. The heterogeneity and anisotropy of the Earth's upper crust require advanced mathematics to generate wave-equation solutions suitable for seismic imaging.

Other inverse problems arise in non-destructive evaluation of materials. The structural changes due to cracks or flaws are used to identify the locations of those defects. Radar and sonar are based on inverse scattering methods. Mathematics plays a crucial role in the understanding and modelling of the inverse problem as well as in finding reconstruction algorithms. During the last twenty years or so there have been remarkable developments in the mathematical theory of inverse problems. These developments together with the enormous increase in computing power and new powerful numerical methods have made it possible to make significant progress on increasingly more realistic and

difficult inverse problems.

Many of the physical situations indicated above are modelled by partial differential equations. The inverse problem is to determine the coefficients of the partial differential equation inside the medium from some knowledge of the solutions, usually on the boundary. Already the interaction between experts in partial differential equations and on inverse problems have produced significant advances.

Faculty

CRG leaders: Gary Margrave (U. Calgary), Gunther Uhlmann (U. Washington)
UBC: Joel Feldman, Richard Froese, Nassif Ghoussoub.
U. Calgary: Paul Binding, Peter Gibson, Michael Lamoureux, Peter Lancaster, Larry Lines, Jedrzej Sniatycki and Tony Ware.
U. Washington: Ken Bube, Edward Curtis, James Morrow, John Sylvester.

Distinguished Chairs

William Symes (Rice) gave three lectures on the *Mathematics of Seismic Imaging* at UBC in July 2005.

Lou Fishman (MDF International) gave four lectures on the *Phase Space and Path Integral Methods in Seismo-Acoustic Wave Propagation Modeling and Imaging* at U. Calgary in September 2005.

Scientific Activities

July 2007: *The Applied Inverse Problems Conference*, Vancouver (please see page 13 for more information)

PIMS-MITACS-VIGRE Summer Graduate School on Inverse Problems, U. Washington, August 1–5, 2005

There were more than 55 participants in the summer school. During the week of the summer school, William Symes from Rice University gave the PIMS Distinguished Lectures on T*he Mathematics of Seismic Imaging.* In addition, the following distinguished researchers gave a minicourse consisting of three one hour lectures covering a broad range of topics in Inverse Problems:

Guillaume Bal (Columbia): *Some Inverse Transport Problems and Their Applications*
Joyce McLaughlin (RPI): *Interior Elastodynamics Inverse Problems: Finding shearwave speed from interior displacements*
Gary Margrave (U. Calgary): *Seismic Imaging: Theory and Promise*
Plamen Stefanov (Purdue): *Tensor Tomography and Boundary Rigidity*
Gunther Uhlmann (U. Washington): *Electrical Impedance Tomography*

Related BIRS Workshops

September 24–29, 2005: *Time Frequency Analysis and Nonstationary Filtering*
August 19–24, 2006: *Inverse Problems and Applications*

William Symes (Rice), PIMS Distinguished Chair.

Quantum Topology: 2005–07

Overview

The problems of interest in this CRG are (i) the so-called "many-body problem" in non-relativistic physics, particularly on lattices in low spatial dimension; and (ii) the problem of finding a universal quantum computer which evades decoherence. Phrased this way, these problems seem almost parochial. However we now know that they are in many ways equivalent, and that moreover they are closely related to important problems in theoretical computation, graph theory, topology, black hole physics and string theory, and non-commutative geometry. There is also a strong relation to problems in number theory.

The main purpose of this CRG is to bring together a group of mathematicians and physicists whose interests are united by the 2 problems stated above. Our aim is to resolve some critical issues, which are issues in both mathematics and physics. The work we plan will focus around the following projects:

1. 1-dimensional Problems
2. Renormalisation Group
3. Topological Methods
4. Numerical Methods
5. New Field Theories
6. Quantum Enviroments and Decoherence
7. Spin Nets of Qubits

Faculty

CRG Leaders: Joel Feldman (UBC), Boris L. Spivak (U. Washington), Philip Stamp (UBC)
UBC: Ian K. Affleck, Mona Berciu, George A. Sawatzky

U. Alberta: Frank Marsiglio
U. Calgary: Richard E. Cleve, John Watrous
SFU: Igor Herbut

Quantum Topology CRG Leaders.

Top row: Philip Stamp (UBC), Boris L. Spivak (U. Washington).

Bottom row: Joel Feldman (UBC).

Recent Activities of Ongoing PIMS CRGs

PIMS CRG on Topology: 2004–06

Hyperplane Arrangements Workshop
UBC, August 21–24, 2005

The conference organizers were **Graham Denham** (U. Western Ontario) and **Sergey Yuzvinsky** (U. Oregon). The topics and speakers were:

Dan Cohen (Louisiana State U.): *Pure braid Monomorphisms*

Nicole Lemire (U. Western Ontario): *Galois Module Structure of Galois Cohomology*

Daniel Matei (Romanian Academy of Sciences): *Local System Homology of Pure Braid Groups*

Laurentiu Maxim (Pennsylvania): *Multivariable Alexander Invariants of Hypersurface Complements*

Graham Denham (U. Western Ontario) and Sergey Yuzvinsky (U. Oregon), the organizers of the Hyperplane Arrangements Workshop.

Richard Randell (U. Iowa): *Some representations of Arrangement Groups*

Franco Saliola (Cornell U.): *The Face Semigroup Algebra of a Hyperplane Arrangement*

**Hal Schenck** (Texas A&M): *Projective Dimension of D(A)*

Misha Shapiro (Michigan State U.): *Cluster Algebras of Finite mutation Type*

Alex Suciu (Northeastern): *Algebraic invariants for Bestvina-Brady groups*

Topics in Homotopy Theory Graduate Summer School
U. Calgary, August 22–26, 2005

The goal of this intensive five-day programme was to provide an opportunity for graduate students in topology to gain exposure to several emerging areas of research in homotopy theory. The speakers were:

Alejandro Adem (UBC): *Orbifolds and Group Cohomology*
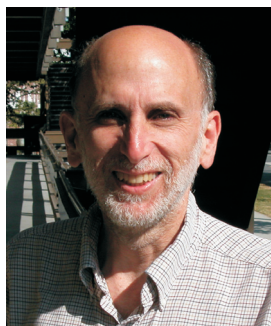
Frederick Cohen (U. Rochester) gave two talks at UBC as a PIMS Distinguished Chair. He spoke about Braid Groups and their Applications in early August 2005.

John Baez (UC Riverside): *Gauge Fields and Homotopy Theory*

Dan Dugger (U. Oregon): *Motivic Homotopy Theory*

Dev Sinha (U. Oregon): *Operads and the Interplay Between Algebraic and Geometric Topology*

PIMS CRG on Dynamics and Related Topics: 2003–05

Summer School in Aperiodic Order
U. Victoria, August 8–13, 2005

The main focus of this event was four series of introductory lectures, consisting of five one hour lectures each. These were mainly intended for graduate students and post-doctoral fellows. The topics and speakers were:

Daniel Lenz (TU Chemnitz): *Diffraction and Discrete Geometry*

Franz Gaehler (U. Stuttgart): *Physics of Quasi-Crystals (for Mathematicians)*

Lorenzo Sadun (U. Texas, Austin): *Topological Aspects of Aperiodic Order*

Boris Solomyak (U. Washington): *Tilings and Dynamics*

The organizers were **Robert V. Moody** (U. Alberta) and **Ian F. Putnam** (U. Victoria).

The participants of the Summer School in Aperiodic Order.

The Northwest Dynamics Symposium
U. Victoria, August 15–19, 2005

The organizing committee consisted of **Chris Bose** (U. Victoria), **Chris Hoffman** (U. Washington), **Doug Lind** (U. Washington) and **Ian Putnam** (U. Victoria).

The speakers included: **Vitaly Bergelson** (Ohio State U.), **Mike Boyle** (U. Maryland), **Bob Burton** (Oregon State U.), **Mike Keane** (Wesleyan U.), **Robert Moody** (U. Alberta), **Dan Rudolph** (Colorado State U.), and **Klaus Schmidt** (U. Vienna).

PIMS CRG on Mathematical Ecology and Evolution: 2003–05

The 4th Annual PIMS-ASRA Mathematical Biology Summer Workshop was an activity of this CRG. See page 30 for a full report.

PIMS CRG on Number Theory: 2003–05

This CRG held three consecutive workshops at BIRS in November of last year. They were:

Explicit Methods in Number Theory
November 13–18, 2004

Number Theorists Weekend
November 18–20, 2004

Diophantine Approximation and Analytic Number Theory
November 20–25, 2004

PIMS CRG on String Theory: 2003–05

As the activities of this CRG wound down, PIMS provided sponsorship for four graduate students or PDFs to attend the following two events:

2005 Summer School on Strings, Gravity and Cosmology
Perimeter Institute, June 20–July 8, 2005

This was the third annual such summer school. For more information including the report see **www.pims.math.ca/science/2005/05sssgc**.

Strings 05
U. Toronto, July 11–16, 2005

This conference included two public lectures:

Robbert Dijkgraaf (U. Amsterdam): *Strings, Black Holes, and the End of Space and Time*

Leonard Susskind (Stanford): *Cosmic Landscape: String Theory and the Illusion of Intelligent Design*

For more information see **www.strings05.ca**.

Banff International Research Station: 5-Day Workshops in 2006

Feb 11–16 Frontiers in String Theory: H. Ooguri (Caltech), B. Greene (Columbia), A. Peet (Toronto), G. Semenoff (UBC)

Feb 18–23 Advances in Computational Scattering: N. Nigam (McGill), D. Nicholls (Notre Dame), F. Reitich (Minnesota, Twin Cities)

Mar 4–9 Convex Sets and their Applications: T. Bisztricky (Calgary), P. Googey (Oklahoma), P. Gritzmann (TU Munich), M. Henk (Magdeburg), D. Larman (UC London)

Mar 11–16 Coarsely Quantized Redundant Representations of Signals: O. Yilmaz (UBC), S. Gunturk (Courant), T. Nguyen (City College, CUNY), A. Powell (Princeton)

Mar 18–23 Reaction-Diffusion and Free Boundary Problems: L. Ryzhik (Chicago), P. Constantin (Chicago), F. Hamel (UPCAM), R. Jerrard (Toronto), J-M. Roquejoffre (UPS Toulouse)

Mar 25–30 Exploring the Frontiers of Dynamic Nuclear Medicine Imaging for Medical and Molecular Applications: M. Trummer (SFU), A. Celler (Vancouver Hospital and Health Science Centre), G. Gullberg (Berkeley Lab), M. King (Massachusetts Medical School)

Apr 1–6 Recent Trends in Higher Dimensional Geometry: J. McKernan (UC Santa Barbara), X. Chen (Alberta), A. Corti (Cambridge), C. Ingalls (New Brunswick), S. Kovacs (Washington), M. Reid (Warwick)

Apr 8–13 BIRS Workshop on Noncommutative Geometry: M. Khalkhali (Western Ontario), A. Connes (IHES), J. Cuntz (Muenster), G. Elliott (Toronto), B. Tsygan (Northwestern)

Apr 15–20 Nonlinear Diffusions: Entropies, Asymptotic Behavior and Applications: J.A. Carrillo (Institucio Catalana de Recerca i Estudis Avancats), E. Carlen (Georgia Tech), J. Dolbeault (Paris Dauphine), P.A. Markowich (Vienna), R.J. McCann (Toronto)

Apr 22–27 Schrödinger Evolution Equations: J. Wunsch (Northwestern), J. Colliander (Toronto)

Apr 29–May 4 Analytic and Geometric Theories of Holomorphic and CR Mappings: S.G. Krantz (Washington, St. Louis), J. Bland (Toronto), H. Gaussier (Provence), K-T. Kim (POSTECH), F. Larusson (Western Ontario), J. Noguchi (Tokyo)

May 6–11 Forests, Fires and Stochastic Modeling: C. Dean (SFU), W. Braun (Western Ontario), F. He (Alberta), D. Martell (Toronto), H. Preisler (USDA Forest Service)

May 13–18 Analytic Methods for Diophantine Equations: A. Granville (Montréal), M. Bennett (UBC), C. David (Concordia), W. Duke (UCLA), Y. Tschinkel (Princeton)

May 20–25 Optimization Problems in Financial Economics: A. Lazrak (UBC), J. Cvitanic (Southern California), N. Touzi (ENSAE Paris)

May 27–June 1 Interfacial Dynamics in Complex Fluids: J.J. Feng (UBC), C. Liu (Penn State)

June 3–8 Modular Forms and String Duality: N. Yui (Queen's), C. Doran (Columbia), H. Verrill (Louisiana State)

June 10–15 Evolutionary Game Dynamics: K. Sigmund (Vienna), R. Cressman (Laurier), C. Taylor (Harvard)

June 17–22 Creative Writing in Mathematics and Science: M. Senechal (Smith College), C. Davis (Toronto), C. Holmes (Banff Centre), J. Zwicky (Victoria)

June 24–29 Statistics at the Frontiers of Science: G. Chen (Calgary), D. Brillinger (Berkeley), J. Fan (Princeton), J. Liu (Harvard), J. Ramsay (McGill), K. Worsley (McGill)

July 1–6 PIMS/UNAM Summer School: A. Adem (UBC), J. Carrell (UBC), J. de la Pena (UNAM)

July 8–13 Computational and Statistical Genomics: S. Keles (Wisconsin, Madison), J. Bryan (UBC), S. Dudoit (Berkeley), K. Pollard (UC Santa Cruz), M. van der Laan (Berkeley)

July 15–20 Statistical inference Problems in High Energy Physics and Astronomy: N. Reid (Toronto), J. Linnemann (Michigan State), L. Lyons (Oxford)

July 22–27 Moduli spaces and combinatorics: J. Bryan (UBC), R. Kenyon (UBC), A. Okounkov (Princeton), R. Pandharipande (Princeton)

July 29–Aug 3 Spin, Charge, and Topology in Low Dimensions: P. Stamp (UBC), V. Frolov (Alberta), G. Sawatzky (UBC), B. Spivak (Washington), W. Unruh (UBC), S. Zhang (Stanford)

Aug 5–10 Measurable Dynamics, Theory and Applications: C. Bose (Victoria), P. Gora (Concordia), B. Hunt (Maryland), A. Quas (Memphis)

Aug 12–17 Geometric and Nonlinear Analysis: F. Robert (UNSA), M. Gursky (Notre Dame), E. Hebey (Cergy-Pontoise)

Aug 19–24 Inverse Problems and Applications: G. Uhlmann (Washington), G. Margrave (Calgary)

Aug 26–31 Recent Advances in Computational Complexity: V. Kabanets (SFU), S. Cook (Toronto), A. Gupta (MITACS), R. Impagliazzo (UC San Diego), M. Sudan (MIT), A. Wigderson (Princeton)

Sept 2–7 Algebraic Groups, Quadratic Forms and Related Topics: A. Merkurjev (UCLA), V. Chernousov (Alberta), R. Elman (UCLA), J. Minac (Western Ontario), Z. Reichstein (UBC)

Sept 9–14 Evolution of Microscopic and Macroscopic Fields: I.M. Sigal (Toronto and Notre Dame), J. Froehlich (ETH Zürich), A. Soffer (Rutgers), M. Weinstein (Columbia)

Sept 16–21 Topics on von Neumann Algebras: J. Erlijman (Regina), W. Hans (UC San Diego)

Sept 30–Oct 5 Mathematical Methods in Computer Vision: M. Jagersand (Alberta), D. Cobzas (INRIA Rhone-Alpes), A. Heyden (Lund), J. Little (UBC), P. Sturm (MOVI), B. Triggs (LEAR), S. Zucker (Yale)

Oct 7–12 Positive Polynomials and Optimization: V. Powers (Emory), S. Kuhlman (Saskatchewan), S. Lall (Stanford), F. Sottile (Texas A&M)

Oct 14–19 Syzygies and Hilbert Functions: I. Peeva (Cornell), M. Stillman (Cornell)

Oct 21–26 Topological Graph Theory and Crossing Numbers: B. Mohar (SFU), J. Pach (Courant), B. Richter (Carleton), R. Thomas (Georgia Tech), C. Thomassen (Tech Denmark)

Oct 28–Nov 2 Hyperbolic Systems of Conservation Laws and Related Problems: W. Craig (McMaster), K. Trivisa (Maryland), G.Q. Chen (Northwestern), C. Dafermos (Brown)

Nov 4–9 A Workshop on Random Media: M. T. Barlow (UBC), E. Bolthausen (Zürich), A.-S. Sznitman (Zürich)

Nov 11–16 Optimization and Engineering Applications: T. Terlaky (McMaster), J. Peng (McMaster), R. Vabderbei (Princeton), H. Wolkowicz (Waterloo), Y. Ye (Stanford)

Nov 18–23 Polynomials over Finite Fields and Applications: D. Panario (Carleton), I. Blake (Toronto), S. Cohen (Glasgow), G. Mullen (Penn State)

Nov 25–30 MITACS Workshop on Industrial Mathematics

Dec 2–7 Operator Methods in Fractal Analysis, Wavelets and Dynamical Systems: D. Kribs (Guelph), O. Bratteli (Oslo), P. Jorgensen (Iowa), G. Olafsson (Louisiana State), S. Silvestrov (Lund)

Dec 9–14 Numerical Methods for Degenerate Elliptic Equations and Applications: A. Oberman (SFU), L. Doron (Stanford), I. Mitchell (UBC), P. Souganidis (Texas, Austin)

Renaissance Banff: Bridges Conference & Coxeter Day

Report by Reza Sarhangi, Towson University. Captions provided by Robert Fathauer, The Tessellations Company.
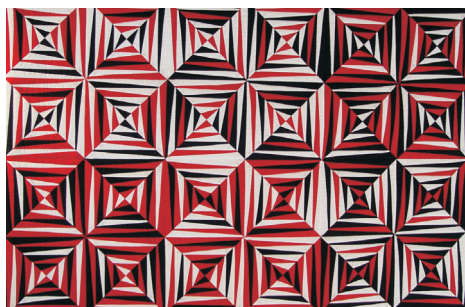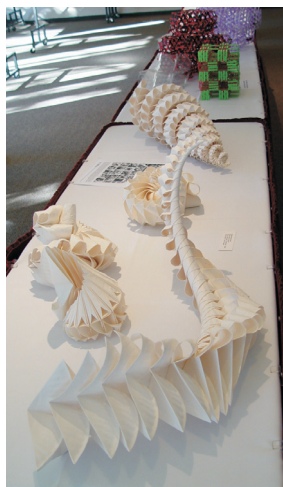

"Cyclic Permutations" is a quilt by Gerda de Vries (Professor of Mathematics, University of Alberta). This quilt explores permutations of the coloring of a geometric design based on right isoceles triangles.

The Renaissance Banff Conference was comprised of the 8th annual conference of *Bridges: Mathematical Connections in Art, Music, and Science*, plus a special *Coxeter Day* commemorating the artistic side of the late Donald Coxeter. It was held at BIRS, July 31–August 3, 2005.

A tribute to the late Donald Coxeter from the exhibition at the Renaissance Banff Conference..

The Coxeter Day, organized in cooperation and with the support of the Canadian Mathematical Society, was about geometry-arts connections that are either related to or inspired by the life and work of Donald Coxeter. H.S.M. (Donald) Coxeter was one of the foremost geometers of the 20th century. His work and writing not only played a significant role in mathematics, but also touched innumerable people in the arts and other areas of science.
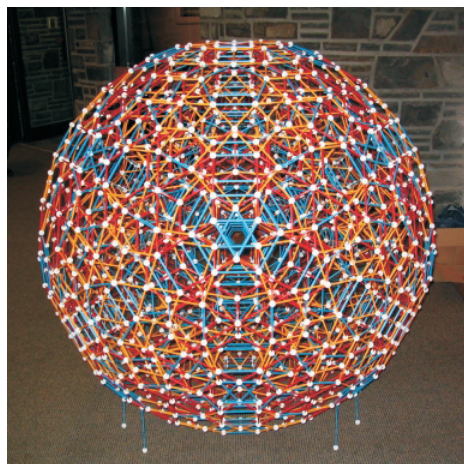
The Bridges Conferences, created in 1998 and running annually since, have provided a remarkable model of how divides between mathematics, art, and music can be crossed. Here practicing mathematicians, scientists, artists, educators, musicians, writers, computer scientists, sculptures, dancers, weavers, and model builders have come together in a lively and highly charged atmosphere of mutual exchange and encouragement. Important components of these conferences, apart from formal presentations, are gallery displays of visual art, working sessions with practitioners and artists who are crossing the mathematics-arts boundaries, and evening musical or theatrical events.

Some comments the organizers received:

"Now that I am home, I want to thank you and BIRS for hosting the Renaissance Banff conference ("Bridges" and Coxeter day) last week. It was a wonderful, rich experience at an outstanding location and the local arrangements were superb... The conference blended mathematics and art together just as Banff itself does. I hope you will consider hosting similar conferences in the future."

"...I found last week's conference one of the most interesting and enjoyable that I have attended during my lifetime—and I am now in my 80th year."

For more information please visit **http://www.pims.math.ca/RenaissanceBanff/**.

"Looking for the Order" painted sphere by Dick Termes (artist living in South Dakota). Termes' painted spheres make use of six-point perspective. This work pays homage to Albert Einstein. The sphere demonstrates a statement by Einstein that if you could look far enough in one direction, you would see the back of your own head.

Folded paper model by Ushio Ikegami. This fractal structure is created by Origami-like folding. The diagram in front of the pyramid shows the fold lines on a flat sheet of paper.

Set of five sculptures created by Bradford Hansen-Smith (business owner living in Illinois) by folding paper plates without cutting.
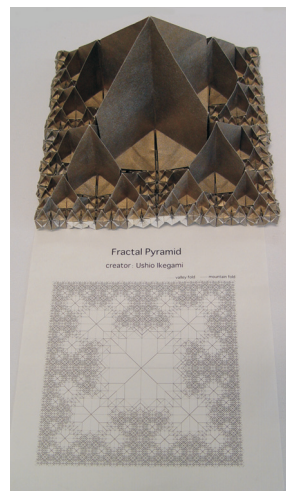

A zome model of a cantellated 600-cell, viewed along a 3-fold axis. For information about the construction, please see David Richter's (Western Michigan University) webpage: http://homepages.wmich.edu/~drichter/bridgeszome2005.htm.

Wood sculture of a trefoil knot by Susan Greene (sculptor and retired research chemist living in Virginia).

Canada Won One Gold, Two Silver and Two Bronze Medals at the 2005 Mathematical Olympiad

Canadian high school students won one gold medal, two silver, and two bronze medals at the 46th International Mathematical Olympiad (IMO), held from July 8-19, 2005 in Mérida, Mexico.

The team attended a special IMO Training Camp at the University of Calgary from June 25–28 before moving to BIRS to train until July 9. A send-off reception with friends, sponsors and invited guests was held on June 28 at the University of Calgary.

The six members of the 2005 Canadian IMO team were: Lin Fei (Don Mills Collegiate Institute, Toronto), Elyot Grant (Cameron Heights Collegiate Institute, Kitchener), Yang (Richard) Peng (Vaughan Road Academy, Toronto), Dong Uk (David) Rhee (McNally High School, Edmonton), Peng Shi (Sir John A. MacDonald Collegiate Institute, Toronto), and Yufei Zhao (Don Mills Collegiate Institute, Toronto), were selected from among more than 200,000 students who participated in local, provincial and national mathematics contests.

The gold medal was awarded to Yufei Zhao, silver medals to Yang (Richard) Peng and Peng Shi, and bronze medals to Elyot Grant and Donk Uk (David) Rhee.

The team was accompanied by the Team Leader, Felix Recio (U. Toronto), the Deputy Team Leader, Dorette Pronk (Dalhousie U.), and the Deputy Leader Observer, Adrian Tang (U. Calgary).

The Canadian team at the send-off reception with Mike Boorman (Dean of Science, U. Calgary).

The Canadian team placed 19th out of 91 competing countries with a score of 132. The top 10 teams and their scores are: China (235); USA (213); Russia (212); Iran (201); Korea (200); Romania (191); Taiwan (190); Japan (188); Hungary (181); Ukraine (181).

Since 1981, Canadian students have received a total of 16 gold, 29 silver, and 57 bronze medals.

PIMS Summer School: BREAD Summer School in Development Economics
BIRS, June 25–July 1, 2005

Contributed by Esther Duflo, Massachusetts Institute of Technology

The Bureau for Research and Economic Analysis of Development (BREAD), in conjunction with PIMS, offered a BIRS summer school in development economics for PhD students, post-docs, and recent graduates. The summer school introduced students to the main concepts in analytical development economics—methodological, theoretical, and empirical—as well as to a variety of statistical and modelling tools.

This was the first edition of the BREAD summer school, and there were 37 participants (selected from over 150) from about 25 universities in the US, Canada, and Europe.

The organizers of the BREAD summer school were **Siwan Anderson** (UBC), **Esther Duflo** (MIT), and **Sendhil Mullainathan** (Harvard).

Participants of the BREAD Summer School.

Multimedia and Mathematics
BIRS, July 23–28, 2005

Contributed by Rabab Ward, Director, ICICS, University of British Columbia

A BIRS workshop organized by ICICS (the Institute for Computing, Information, and Cognitive Systems at UBC) brought university and industry together to share ideas about the latest advances in multimedia and mathematics. Multimedia technol-

Rabab Ward at the BIRS meeting.

ogy affects the way we communicate, work, and play. Its diverse applications include text, audio, speech, music, images, and video, as well as sensor data, such as environmental measurements from sensor networks, and biological data from medical devices.

The forty attendants (29 men and 11 women) were from Canada, UK, Australia and the USA. They were 6 graduate students and 26 faculty members from 24 universities and 8 researchers from Microsoft, Apple, Hewlett Packard, Tiz Media Foundation and NSF. The participants described the approaches, advances, and constraints in their specific areas of media. With a focus on discovering common ground, they explored the mathematical modelling, analysis, and representation of the information in their respective media fields. Their topics included coding, statistical learning, recognition, retrieval, signal processing, classification, segmentation, communication, network coding, multimedia forensics and security, human movements, and mobile devices. Another discussion topic was the role of multimedia in promoting mathematics among under-represented minorities.

From this workshop rich in cross-fertilization, participants gained new insights into the possibilities for solving the latest technical challenges.

8th PIMS Graduate Industrial Mathematics Modelling Camp
University of Lethbridge, May 7–11, 2005

Contributed by Daya Gaur, University of Lethbridge

The 8th Annual PIMS Graduate Industrial Mathematics Modelling Camp (GIMMC) was held at the University of Lethbridge May 7–11, 2005. Thirty-three students from all across Canada and USA participated in the camp. GIMMC provides the students in mathematical sciences with an opportunity to learn mathematical modelling techniques under the guidance of the experts, and is the first leg of the PIMS Industrial Mathematics forum. A forum that includes the Industrial Problem Solving Workshop (IPSW).

The organizing committee consisted of **Elena Braverman** (University of Calgary) and **Hadi Kharaghani** (University of Lethbridge).

On the morning of the 8th, the mentors presented the problems, and subsequently guided their groups to a resolution. At the end each group presented their work. The presentations are available in video at **http://www.pims.math.ca/industrial/2005/05gimmc/**. The proceedings based on the written reports is to be published and will be available at the above site too.

The Mentors and the problems were:

C. Sean Bohun (Pennsylvania State University): *Modelling a Stirling engine*
The group modelled the operation of the Heat Economiser, patented by Rev. Robert Stirling in 1816. This is an example of an engine that is externally heated and as a result, it can be operated with any fuel that can provide a temperature differential. It has the added advantage that it is very quiet when operated. In addition, by applying an external mechanical motion, this engine can act as either a heater or cooler. This engine is used as a cryocooler for image sensors in weather satellites.

Chris Bose (University of Victoria): *A dynamic model for the rotary rock drill*
The group developed a model of the tri-cone drill, a type of simple rock drill that is used widely. The following factors were taken into

Chris Bose's group.

account; the applied force, the weight of the drill and rotating machinery, the geometry of the drill head, chipping points, and the angular speed of rotation of the drill. In order to deal with the chaotic mode of operation a discrete-time dynamical system model was chosen.

Lou Fishman (MDF International): *Phase Space, Path Integral, Invariant Imbedding, and Dirichlet-to-Neumann Operator Methods in Seismo-Acoustic Wave Propagation with Application to Imaging and Inversion*
The group addressed Seismo-acoustic wave propagation modelling in complex, layered environments extending over very large domains. They developed an extension of Fourier analysis for the solution of the wave equation with a non-constant coefficient corresponding to an inhomogeneous medium. A marching algorithm that incorporates the backward scattering into the evolution of the wave was developed by exploiting the underlying physics of the problem.

Daya Gaur's group.

Daya Gaur (University of Lethbridge): *Problems in facility location optimization*
Typical problems in facility location optimization include placement of factories, warehouses, schools, ATM machines and proxy servers in content distribution networks on the internet. The group examined approximation algorithms, based on the primal-dual schema, for two variants of the facility location problem.

For further information please see **http://www.pims.math.ca/industrial/2005/05gimmc/**.

Sean Bohun's group.

Lou Fishman's group.

9th PIMS Industrial Problem Solving Workshop
University of Calgary, May 15–19, 2005

Contributed by Elena Braverman, University of Calgary

The 9th Annual PIMS Industrial Problem Solving Workshop (IPSW) was sponsored by PIMS, Alberta Innovation and Science, iCORE and the University of Calgary. Participants from all across Canada (from Memorial University at St. John's, NL, in the east to the University of Victoria in the west) and the United States arrived to take part in the workshop. The event was preceded by the 8th PIMS GIMMC, where the graduate student IPSW participants had already mastered some mathematical modelling techniques under the guidance of experts.

The IPSW organizing committee consisted of **Elena Braverman** and **Gary Margrave** (both from U. Calgary).

In the morning of May 15 industrial problems were presented. During four subsequent days forty students, about twelve professional academics and four industry representatives worked in collaboration to resolve these problems. Final presentations on May 19 outlined the progress achieved in all five problems.

The five problems and presenters were:

Donald M. Henderson (Verterbrate Morphology and Palaeontology Research Group, U. Calgary, in collaboration with Royal Tyrrell Museum of Palaeontology, Drumheller): *Models of the mechanics and dynamics of dinosaur tails*
The group investigated the motion and oscillations of the tails of dinosaurs. Unlike mammals, dinosaurs had tails which represented a substantial fraction of their body lengths and masses. It is expected that the movement of the body led to tail oscillations; tail movements could be also essential for balance purposes. The extreme sizes of some dinosaurs (up to 30 tonnes in some cases) and the great range of body sizes (from a few hundred grams to many tonnes) makes them insightful models for the study of locomotory dynamics in terrestrial animals. The results may also differ between four-legged and two-legged dinosaurs.

The group developed four approaches to the problem: the dimensional analysis of the problem, the discrete approach (representing a dinosaur's body as a collection of "moving connected cylindrical slices"), considered a tail as an elastic beam and the equal arc-length approach (which, unlike a stiff beam, imposed only the condition that the length of the tail be preserved).

Gerald K. Cole (Human Performance Laboratory Faculty of Kinesiology, U. Calgary, in collaboration with CEO, Biomechanigg Research Inc. which worked with Adidas): *Designing running shoes*
A robotic system was developed to replicate the mechanics of the contact between the shoe and the ground during human locomotion. The system has six degrees of freedom; the input to the system is the movement of the platform, the outputs are the force and the momentum acting on the foot over time. The purpose was to develop a method which can identify the 3-D movement path of the platform that is required to produce a specified time profile of force and moment acting on the foot.

Using local linearization and PDE approaches, considering path optimization, the problem solution was advanced. The group also noted that irreversibility and robustness of the system should be analyzed.

Pierre Lemire and **Rob Pinnegar** (Calgary Scientific): *Identification of seismic layers using classification of pixels' local spectra*
The global objective of the project was to identify layers in seismic pseudo-sections which is crucial in oil field analysis. Under the approach which is currently being developed by Calgary Scientific, pixels are classified based on their local characteristics. The local spectrum of each point of a 2-D image is obtained by S-transform. However the classification technique involved finding a dominant peak in each local spectrum. This method was not satisfactory,

because the feature of interest does not necessarily dominate at every pixel. Thus second-largest and third-largest peaks may also be significant. The problem stated for the workshop was to find ways of identifying these secondary peaks.

The development was in three directions: application of slicing methods (which works well when the local spectra is smooth), cluster analysis and a subtraction technique which identified and subtracted the highest peak, then proceeded to the next one, etc.

Brad Bondy (Genus Capital Management, Vancouver): *Adaptive statistical evaluation tools for equity ranking models*
A major challenge in investment management is to identify stocks that are likely to outperform in the future. To this end the factors which are associated with future out-performance (like earnings-to-price ratio, dividend yield, etc.) are chosen; the "best" factors are incorporated into a model which we use to rank our universe of

The IPSW 2005 participants.

MITACS News

Honouring Tom Brzustowski

Contributed by Megan Airton, Communications Director, MITACS

On May 13, 2005, at the MITACS Annual Conference, a banquet was jointly held by MITACS, PIMS, the Fields Institute and CRM in honour of Dr. Tom Brzustowski on the occasion of his retirement from NSERC.

Dr. Brzustowski, in his 10 years as President of NSERC, championed the importance of investing in research at Canadian universities and institutes and was renowned for fostering the spirit of innovation.

The festivities began with emcee Nassif Ghoussoub (Scientific Director, BIRS) recollecting Dr. Brzustowski's key role in advancing the Canadian mathematics community by supporting such initiatives as the MITACS funding application and the creation of PIMS and BIRS.

The banquet included tributes from Barbara Lee Keyfitz (Director, Fields Institute), Nigel Lloyd (Executive Vice-President, NSERC), Francois Lalonde (Director, CRM), Michael Stevenson (President & Vice-Chancellor, SFU), Ivar Ekeland (Director, PIMS), William Rundell (Director of the Division of Mathematical Sciences, US NSF) and Harvey Weingarten (President & Vice-Chancellor, U. Calgary). Each of the speakers expressed appreciation for Dr. Brzustowski's leadership, vision and commitment and wished him well in his future endeavours.

Nigel Lloyd (Executive Vice-President, NSERC), Tom Brzustowski (President, NSERC) and Nassif Ghoussoub (Scientific Director, BIRS).

*A **PIMS-MITACS Two-Day Minicourse in Financial Economics** was held at PIMS-UBC, July 4–5, 2005. Elyes Jouini (U. Paris Dauphine) gave a series of four lectures on* Equilibrium models with beliefs heterogeneity. *The photo shows Ivar Ekeland (PIMS), Elyes Jouini (U. Paris Dauphine), Ali Lazrak (Sauder School of Business, UBC) and Calvin Winter (Alpha Lake Financial Analytics).*

2011 ICIAM to be Held in Vancouver

Reprinted from the June 2005 edition of the MITACS newsletter, Connections.

The combined efforts of CAIMS (the Canadian Applied and Industrial Mathematics Society), MITACS and SIAM (the Society for Industrial and Applied Mathematics in the US) have resulted in Vancouver being awarded the bid to host the 7th International Congress on Industrial and Applied Mathematics conference, or ICIAM, from July 18–22, 2011.

Occurring every four years, ICIAM is the largest international conference in applied mathematics, attended by more than 2000 attendees. The conference attracts high profile, internationally renowned speakers and aims to promote industrial and applied mathematics globally, as well as encourage interactions between member societies and countries to further international collaboration.

CAIMS, MITACS and SIAM are developing an innovative programme for ICIAM 2011 that will include an integrated industry programme highlighting the many contributions of applied and industrial mathematics to industry. There will be sessions specifically targeted to industry participants, graduate students, academics and the public at large. A particular commitment by all three partners is ensuring strong participation by scientists from developing countries.

The president of ICIAM 2011 will be Arvind Gupta, Scientific Director of MITACS who will chair the organizing committee. The scientific programme committee will be co-chaired by Ivar Ekeland, Director of the PIMS and Jerrold Marsden, a professor at the California Institute of Technology. As well, North American mathematical sciences institutes, professional societies and universities have shown strong support and willingness to help ensure that ICIAM 2011 is an outstanding event.

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stocks. These models need to be adaptive, in order to avoid the risk of delaying introduction of a new factor until the market has already cleaned it out. The problem for IPSW was to recommend adaptive statistical evaluation tools to dynamically update the models.

Using the genetic optimization (where the performance of the portfolio is to be optimized), the constrained regression approach and an arti-

ficial Neural Network, the group obtained promising results outperforming the benchmark (especially with the first and the second methods).

Brian Russell (Hampson-Russell Software, a Veritas Company, Alberta): *Seismic prediction of reservoir parameters*
Assuming there is a set of multivariate observations (which is a set of seismic attribute values), it is necessary to find an approximating func-

tion which is the closest to the data in the sense of the least-squares criterion. The analysis is done for various types of data corresponding to different wells.

Several parametric and non-parametric approaches were suggested, among which the spline method outperformed the others.

More information, including the final presentations, is available at **http://www.pims.math.ca/industrial/2005/05ipsw/**.

PIMS Education Day 2005

Contributed by Chris Bose, PIMS Site Director, University of Victoria

On June 1, approximately 40 academics and educators, along with university and government administrators, met at the University of Victoria for the first annual PIMS Education Day.

Two keynote speakers addressed the group during the morning session. George Bluman (UBC) is well-known throughout North America for his passionate views on mathematics and education. George gave the audience a broad view of BC and Canadian Mathematics Education, both past and present, as well as numerous reasons to have hope for the future. Our second keynote speaker was Hon. Ida Chong, Minister of Advanced Education for BC. Minister Chong recognizes the importance of numeracy and mathematical literacy, and left no doubt about the BC government's commitment to continue improving science and technology training over the next few years.

Ida Chong, at the 2005 PIMS Education Day. She was the BC Minister of Advanced Education at the time of the event.

The event included the presentation of the 2005 PIMS Education Prizes, generously funded this year by Hugh Morris of Padre Resource Management. The awards were presented by Dr. Richard Keeler (Associate Vice-President Research, U. Victoria), who also spoke about each of the awardees and their accomplishments. The prize winners were David Leeming, University of Victoria, and Jim Morrow, University of Washington.

David Leeming's award recognized his decades of service to university and high-school education. Highlights include Math Mania, First Nations Educational Initiatives and editorship of Pi in the Sky, the popular PIMS magazine aimed at high-school students.

Jim Morrow's accomplishments have won him numerous accolades from colleagues and the media. Highlights include MATHDAY at the University of Washington, coaching UW's winning math modelling teams and the Summer Math Institute for high-school students. Jim was also a key figure in the highly regarded UW initiated and NSF-funded

> Thank you to **Hugh Morris** (Padre Resource Management) for funding the 2005 PIMS Education Prizes.

David Leeming (U. Victoria) and Jim Morrow (U. Washington), winners of the 2005 PIMS Education Prizes.

Research Experience for Undergraduates.

We hope to see you at the Second Annual Education Day next year.

To view video segments of the event please consult the PIMS web site.

Richard Keeler (Associate VP Research, U. Victoria), Hugh Morris (Padre Resource Management), and Jim Morrow (U. Washington) as he was presented with his prize.

PIMS Collaborates with First Nations Communities in BC

Contributed by Melania Alvarez-Adem, BC Education Coordinator, PIMS

PIMS is forming new and varied partnerships with the First Nations Education Steering Committee (FNESC) in BC.

David Leeming represented PIMS at the 10th Annual Provincial Conference on Aboriginal Education in Vancouver, November 6–8, 2004, where he held Math Mania worshops involving demonstrations and training sessions.

Math Mania went to the First Nations Com-

Got Your Goat at the Agassiz Math Mania event.

The Error Correction Game, Agassiz Math Mania.

munity of Agassiz at Seabird Island Community School on February 18, 2005.

On May 26–27 FNESC, in collaboration with PIMS, held a Vancouver workshop for elementary and secondary teachers and principals of First Nations schools.

PIMS organized teacher training, August 22–26, 2005, in Kamloops at Sk'elep School of Excellence.

A mentorship programme is being set up for First Nations students with math undergraduate students from Thompson Rivers University.

This pilot teacher training and mentorship programme is possible due to donations by Haig Farris (Fractal Capital Corp), Andrew and Helen Wright (Willow Grove Foundation), and Dr. Ken Spencer (co-Founder & ex-CEO, CREO).

JUMP Update

In 2005 PIMS is continuing to support JUMP (Junior Undiscovered Math Prodigies). On April 21 John Mighton (JUMP) came to PIMS-UBC for a feedback and question session. It was attended by teachers and tutors who are currently implementing the JUMP programme. Another session was held on August 31.

BC Science Fair: Workshops and PIMS Prizes

Contributed by Melania Alvarez-Adem, BC Education Coordinator, PIMS

The BC Science Fair was held at UBC, April 7–9, 2005. It was followed by the Canada Wide Science Fair at UBC, May 15–22, 2005.

PIMS held two presentation workshops for grade 7, 8 and 9 students attending these science fairs. The workshops took place on April 8 and May 16.

Mark Maclean (Science One, UBC) ran *Bubbles and Topology* sessions. *Maple: Where Mathematics Meets Technology* sessions were presented by Veselin Jungic & Mohammad Ali Ebrahimi.

At the regional science fair PIMS presented awards in the mathematical sciences division. For the Best Pure Math project Elizabeth Du (Churchill) recieved a cash prize of $100. In the Applied Math section Jennifer Loong (York House) and Gary Hou (Robert A. McMath) received prizes of $200 and $100 respectively.

Scenes from the BC Science Fair Bubble and Topology *workshop which took place at PIMS.*

The FAME 2005 senior winners from Lambrick Park School.

FAME 2005

Contributed by Wendy Swonnell, Lambrick Park Secondary School, Victoria

This year's Forever Annual Math Exhibition (FAME) was held at S. J. Willis Auditorium on May 17. There were 10 senior entries, 5 middle school entries, and 22 elementary and a total of 69 students. The six schools involved were: Lambrick Park (10) , Arbutus (3), Hillcrest (10), Frank Hobbs (12), Campus View (1) and Craigflower (1). Their number of entries appears in brackets.

There were 12 distinction awards (scores 90% +):
Elementary: Hillcrest (2), Campus View (1), Frank Hobbs (3).
Middle School: Arbutus (2), Hillcrest (1).
Senior: Lambrick Park (3).
The winning schools were Frank Hobbs (elementary), Arbutus (middle) and Lambrick Park (senior).

ELMACON 2005

The 7th Annual PIMS Elementary Grades Math Contest (ELMACON) took place at UBC on Saturday April 30. It was the most successful yet, with over 300 students participating, a record number. This year ELMACON was combined with a Math Mania event which involves fun methods of teaching math and computer science concepts to children (and adults!). Games and art are used and there are lots of hands-on activities.
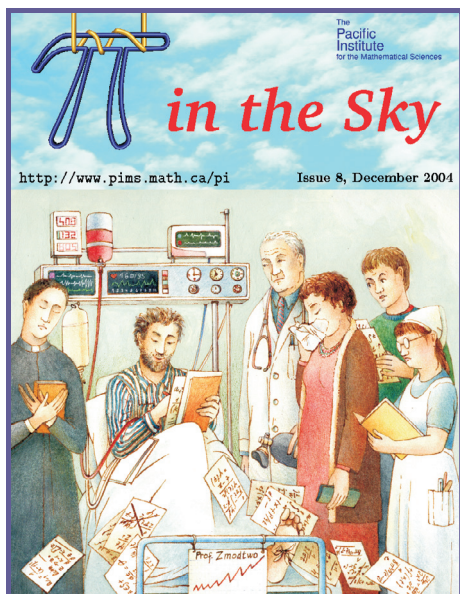

The top 10 ELMACON winners from each grade with Ivar Ekeland (PIMS Director).

ELMACON is open to BC Lower Mainland students in Grades 5 to 7. It gives them a chance to experience mathematics as an exciting sport. ELMACON consists of three rounds starting with the written component, the Sprint and Target rounds. The top 10 students in each grade go on to the Countdown round where contestants 'duel' against each other. It starts with the 9th and 10th ranking contestants, and the winner of that contest goes on to 'duel' the 8th place holder. So the contestant who is ranked 10th after the first two rounds has the potential of winning the contest by beating the 9 contestants ahead of him/her. The dueling consists of answering math questions against the clock and sounding a buzzer.

The Sorting Network from the Math Mania event held during ELMACON.

For the full report on the 2005 contest, including the list of top 10 winners, please see **http://www.pims.math.ca/The_news/Latest_News/ELMACON_2005**.

Changing the Culture 2005: Mathematics for All?

Contributed by Malgorzata Dubiel, Simon Fraser University

The 8th Annual Changing the Culture Conference again brought together mathematicians, mathematics educators and school teachers from all levels, to work together towards improving teaching of mathematics. It took place at the SFU Harbour Centre on April 22.

Keith Devlin (Stanford) gave a public lecture on *The Math Instinct: The amazing mathematical abilities of animals, birds, insects, and babies, and what we can learn from them.* **Philip Loewen** (UBC), the receipient of the 2005 CMS Excellence in Teaching Award, gave a talk on *Inspiring Students in Mathematics Classrooms.*

Rina Zazkis, **Tanya Berezovski**, **Calin Lucus** and **Natasa Sirotich** (SFU) spoke about *Understanding Mathematical Concepts.* The conference also included two workshops and a panel discussion.

For more information see **http://www.pims.math.ca/education/2005/05ctc/**.
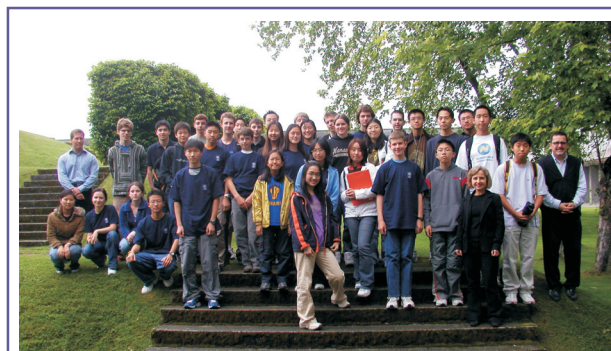
*The participants of the **2005 ESSO–CMS–PIMS Math Camp** which was held at SFU, June 27–30, 2005. These math camps are designed to provide high-school students, who have demonstrated a talent for mathematics, with a variety of enrichment activities in a fun and rewarding environment. This year, 35 participants were selected out of a record 90 applications. The students attended exciting talks and problem solving sessions. For the first time, their teachers were also invited to a special talk and an afternoon reception. For more information, see the camp website: **http://www.cecm.sfu.ca/~lisonek/MathCamp.htm**.*

Alberta Colleges Mathematics Conference and the 5ᵗʰ Annual North-South Dialog in Mathematics

The 2005 Alberta College Mathematics Conference took place on April 29 at Grant MacEwan College in downtown Edmonton. It was a very informative conference about the teaching issues specific to the colleges and their math course offerings.

The 5ᵗʰ Annual North/South Dialog was sponsored by PIMS and it took place on April 30 and May 1 at the same location. The morning sessions included curriculum reports while the afternoon sessions were devoted to research talks. The kenote address was given by Leo Neufeld (U. Victoria) and was on *BC Common Curriculum Eliminates Transfer Evaluations.*

For more information please see **http://www.artsci.macewan.ca/NorthSouthMath2005/**.

Math in Budapest with Art History: A University of Calgary Credit Travel Study Programme

A group of students from the University of Calgary, either from the Department of Mathematics and Statistics or from the Engineering Faculty, traveled to Budapest, Hungary as part of a Credit Travel Study Program, arriving at the end of May 2005 and studying for the month of June. The Group Leader was Marguerite Fenyvesi, and the Instructors were Yousry Elsabrouty for AMAT 307/311 – Differential Equations, and from Hungary Karoly Boroczky Jr. for MATH 311 – Linear Methods II and Janos Szirmai with Gabriella Szigethy for ARTH 205 – Art History. Marton Naszodi was the mathematics tutorial instructor. The students all took two of the three courses offered.

For a full report, by Marguerite Fenyvesi, please see **http://www.pims.math.ca/education/2005/05budapest/ Budapest_Report.pdf**.

Participants in Budapest.

The picture on the cover of the December 2004 issue of *Pi in the Sky* was created by Czech artist **Gabriela Novakova**. The scene depicted was inspired by the article by **Marjorie Wonham** on *The Mathematics of Mosquitoes and West Nile Virus*. The article is part of the theme *Mathematical Models and Infectious Disease Dynamics*. Other related articles related to this theme are *What does Mathematics have to do with SARS?* by **Fred Brauer**, and *Mathematical Modelling of Recurrent Epidemics* by **David J. D. Earn**.

The issue also includes the editorial *On Being the Right Weight* by **Klaus Hoechsman**n, *Cid, Bru, One* by **Jeremy Tatum**, *Kolmogorov, Turbulence, and British Columbia* by **Bob Stewart** and **Chris Garrett**, and *Tribonacci in the Sky: A Mathematical Mountain Walk* by **Achim Clausing**.

The next issue of *Pi in the Sky* magazine will be out in the fall.

Mathematics of Biological Systems 2005: 4th Annual PIMS-ASRA Mathematical Biology Summer Workshop

Contributed by Thomas Hillen, University of Alberta

These summer workshops aim to introduce students to mathematical modelling and analysis applied to real biological systems. Through lectures and exercises, students are introduced to various techniques of mathematical modelling (discrete models, ODEs, PDEs, stochastic models). With a self-guided tutorial the students learn how to use Maple to simulate mathematical models and relate them to biological data. Through projects, teams of 2–3 students experience the modeling process. This year, students worked on the following projects:

- HIV in Cuba 1986-2000
- Cholera in South Africa 2000/01
- Extinction of a Wolf Population in Sweden 1991
- Growth of Cell Populations
- Cell Competition
- Pupil Control
- Radiation Treatment of Cancer

The workshop ran from May 2–12, a total of eleven days. The first set of 5 days included lectures and exercises, and the self-guided Maple tutorial. Then we had one day off and a second set of 5 days, where students worked on projects and presentations. The workshop was held at the Centre for Mathematical Biology at the University of Alberta.

The workshop was attended by 14 students from all over Canada. Typical students had completed 2–3 years of undergraduate study in mathematics or a similar quantitative science. Some graduate students in biological and medical sciences interested in mathematical modelling attended the workshop. All students received a scholarship to cover registration, part of the travel expenses and accommodation.

The instructors were: **Thomas Hillen** (Associate Professor, U. Alberta), **Mark Lewis** (Canada Research Chair in Mathematical Biology, U.Alberta), **Frithjof Lutscher** (PIMS PDF, U. Alberta & U. Calgary), **Alex Potapov** (Research Associate, U. Alberta) and **Rebecca Tyson** (Assistant Professor, Okanagan University College). We were proud to have as the guest lecturer **Michael Mackey** (McGill).

This workshop is an activity of the PIMS Collaborative Research Group on Mathematical Ecology and Evolution. It was supported by PIMS, ASRA (Alberta Innovation and Science), the Department of Mathematical and Statistical Sciences University of Alberta and the CMS (Canadian Mathematical Society).

The project presentations can be found at **www.math.ualberta.ca/~mathbio/ summerworkshop**.

Some of the students comments from previous years:

"I think the biggest thing I got out of the workshop was an appreciation of the wide variety of modeling applications (especially through the projects) and also the immense power of a relatively limited set of techniques."

"This workshop not only helped me to gain experience in Mathematical Biology, but also to decide my direction in my academic career."

"It gave me a good overall look at math modeling... I now know what a mathematical model is. It's a phrase I hear a lot, but wasn't exactly sure what that meant. I also now have a clearer vision of a direction that I'd like to take in graduate studies."

The instructors (l–r): Mark Lewis, Rebecca Tyson, Thomas Hillen, Alex Potapov, Frithjof Lutscher.

Participants in the Mathematics of Biological Systems 4th Annual PIMS-ASRA Mathematical Biology Summer Workshop.

Connecting Women in Math Across Canada II

Contributed by Malgorzata Dubiel, Simon Fraser University

The CMS Committee for Women in Mathematics, in cooperation with PIMS and BIRS organizied the 2005 Connecting Women in Math Across Canada (CWiMAC) workshop for women graduate students in the mathematical sciences at Canadian universities. It took place at BIRS from July 21–23, 2005. It was designed to continue the work started by the very successful CWiMAC which took place June 12–13, 2003, at the University of Alberta.

The thirty participants attended two plenary talks in mathematics, given by **Barbara Keyfitz** (Fields Institute) and **Neeza Thandi** (actuary), and panel and small group discussions. Each participant gave a 20 minute presentation on their research interests or presented a poster.

The CWiMAC workshops are intended to be an integral part of developing a mentoring network to help young women interested in pursuing research in the mathematical sciences, by giving them opportunity to meet women mathematicians working at Canadian and US universities. They also have the opportunity to present their research to a peer group, as well as learn various career strategies: how to present a paper, how to organize their research goals, etc. They are able to meet other women graduate students from across Canada and from Washington State, and share their experiences.

The organizers of the 2005 workshop were **Judith McDonald** (Washington State University), **Malgorzata Dubiel** (SFU), **Rachel Kuske** (UBC) and **Gerda de Vries** (U. Alberta).

AARMS Summer School 2004

Contributed by Hermann Brunner, Director of AARMS

The annual AARMS (Atlantic Association for Research in the Mathematical Sciences) Summer School was held for the third year in a row at Memorial University in St. John's from July 12 to August 6, 2004.

Four courses were offered: *Number Theory* by **Michael Bennett** (UBC), *Number Theoretic Cryptology* by **Renate Scheidler** (U. Calgary), *Statistical Genomics* by **Priscilla Greenwood** (Arizona State and UBC), and *Mathematical Biology* by **Brian Sleeman** (Leeds, UK).

While still in its infancy, the AARMS Summer School is becoming increasingly well known. We had over 100 applications and accepted 30 students from Austria, Croatia, Italy, Poland, Romania, Turkey and Spain, as well as the U.S. and Canada (six provinces).

AARMS activities are funded by Dalhousie University, the University of New Brunswick, Memorial University, Acadia University, and the three Canadian mathematics institutes, the Fields Institute, the Centre de Recherches Mathematiques and PIMS. Again, we acknowledge with gratitude the financial support from the Student Committee of the Canadian Mathematical Society, from MITACS, and from Aliant, Atlantic Canada's telecommunications company. In addition, AARMS is grateful for the support we received from the Centre for Information Security and Cryptography at the University of Calgary.

We encourage all readers of the PIMS Magazine to send students to next year's AARMS Summer School. The school has a web site at **http://www.math.mun.ca/~aarms/summerschools**.

Photos from the 2004 AARMS Summer School at Memorial University, St. John's.

Alberta Conference for Young Researchers in Mathematics

Contributed by the organizer Peter Papez, University of Calgary

The Alberta Conference for Young Researchers in Mathematics is an event established to promote the research of graduate students and encourage collaboration amongst graduate students in Alberta. The 2005 conference was a tremendous success. Graduate students from the University of Calgary and the University of Alberta came together on April 9 and 10 to present their research and collaborate. This is the second year that this conference has been held. In 2004, the University of Alberta hosted, and so it was fitting that this year the host was the University of Calgary.

This conference strengthened the academic ties between the universities in Alberta by getting the young researchers in this province talking to each other. To inspire the collaborative process, students from each university learned about what other students were researching.

Eighty-three students attended and more than a third of these students gave presentations. In fact, 32 very enthusiastic young researchers gave passionate presentations about their work. They presented in the following disciplines: algebra, number theory, cryptography, discrete geometry, convex geometry, topology, differential equations, financial mathematics and statistics, to name just a few. In total there were 18 hours of presentations squeezed into two short days. By scheduling three concurrent sections, everyone who had the desire to give a presentation was able to do so. Each section was completely full and there was not even a minute to spare, anywhere. Organizers divided the three sections into categories by general area of interest: Pure Math/Applied Math, Applied Math/Differential Equations, and Financial Math/Statistics. This way students could attend talks suited to their own research interests. This was a good arrangement and all three sections ran at full capacity.

One example of collaboration witnessed at the conference involved the geometry students from the University of Alberta and the University of Calgary. The students from each univer-

Graduate students at the Alberta Conference for Young Researchers in Mathematics.

sity attended the talks of their counterparts from the other university. They discussed the different techniques of research the two universities use. At the University of Alberta, researchers employ statistical methods, whereas at the University of Calgary computational methods are used. Both universities have a very successful programme, but the methods utilized are very distinct. By discussing the different techniques, various problems that each group was exploring independently seemed solvable by using the other school's methods.

The Department of Mathematics and Statistics at the University of Regina offers degrees in mathematics, statistics and actuarial science. With 26 faculty members it is the largest mathematics department of the three universities in the province of Saskatchewan. The principal areas of research are algebra and number theory, discrete mathematics, geometry and topology, linear algebra, operator algebras, and probability theory and statistics. The department also has a variety of outreach activities including an annual math camp, the Saskatchewan Math Challenge — a contest for grades 8–10 students and Math Central, a collection of Internet services for the K–12 mathematics community.

For more information about the department please see **http://www.math.uregina.ca/**.

Shaun Fallat, U. Regina.

University of Regina.

PIMS Fund Drive 2005

As you will have read in this newsletter, PIMS is involved in promoting the mathematical sciences through a wide range of activities. However, we have a limited budget for carrying out projects connected to important areas such as mathematics education. Private donors can make a huge difference here. For example, this past year generous gifts by donors made it possible for us to initiate a partnership with a First Nations school in Kamloops BC (see article on page 27) and develop a mentorship programme involving undergraduates at Thompson Rivers University.

I would like to take this opportunity to ask readers of this newsletter to consider making a donation to PIMS. This extra support can go a long way towards helping us link our institute to communities in Western Canada where we feel that PIMS can make a difference.

Please make your cheque payable to *Pacific Institute for the Mathematical Sciences*, 1933 West Mall, University of British Columbia, Vancouver BC V6T 1Z2, Canada. You may specify if you would like your contribution to be used for educational activities, otherwise it will simply be used for other worthy purposes. Be sure to include a return address so that we can send you a tax receipt.

Thanks in advance for your support! *Alejandro Adem, PIMS Deputy Director*

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- The Natural Sciences and Engineering Research Council of Canada
- The Government of the Province of Alberta
- The Government of the Province of British Columbia
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- University of Alberta
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- University of Calgary
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- University of Washington
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- University of Regina

Editors: **Heather Jenkins** and **Stefanie Krzak**.
This newsletter is available on the web at **www.pims.math.ca/ Publications_and_Videos/PIMS_Magazines/**.

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