



Pacific Institute for the Mathematical Sciences

Annual Report 2006 | 07

The Pacific Institute for the Mathematical Sciences

MISSION STATEMENT

The Pacific Institute for the Mathematical Sciences (PIMS) was founded and is maintained by the five main universities in Western Canada (Simon Fraser University, University of Alberta, University of British Columbia, University of Calgary, and University of Victoria). In 2005 the University of Washington joined this group of Canadian universities, thereby extending PIMS influence into the United States.

PIMS objectives are:

- Promoting research in mathematics;
- Strengthening ties and collaboration between mathematical scientists in the academic community, in the industrial and business sector, and in government;
- Enhancing education and training in mathematical sciences, and broadening communication of mathematical ideas; and
- Creating strong mathematical partnerships and links within Canada and with organizations in other countries, focusing on Pacific Rim nations.

PIMS has a close partnership with the Mathematical Sciences Research Institute (MSRI), and the Mathematics of Information Technology and Complex Systems (MITACS). The Universities of Lethbridge, Northern British Columbia, and Regina are affiliates.

In its nine years of existence, PIMS has developed numerous ways in which to fulfill the objectives set by its founding universities. These include Collaborative Research Groups, various Scientific, Education, and Industrial activities, the Banff International Research Station (BIRS), and Postdoctoral Fellowships. As the Director of PIMS, I am committed to continuing in this direction, as well as exploring other ways in which PIMS can contribute to mathematics, science, and education.

Ivar Ekeland
PIMS Director

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Message from the Director



*Ivar Ekeland
PIMS Director*

I was lucky enough to benefit from an excellent education in mathematics. Very early on, it struck me that mathematics is a school for critical thinking and personal freedom. When I was much younger, mathematics taught me to argue, and now it teaches me to listen. Not many children benefit from this kind of education nowadays. I also note that although mathematics are universal, and in principle should be the least sensitive to cultural, social, and gender barriers, in reality it is the privileged in society who have the best exposure to mathematics, with others being too often considered unworthy of high expectations. This is the reason why PIMS has gone so strongly into mathematical education. For many years, PIMS has been on the forefront of mathematical education and outreach in Alberta and B.C., with such events as Math Fairs, Math Mania and ELMACON.

Since 2005, we have intensified our efforts by appointing Melania Alvarez-Adem as Education Coordinator in B.C., with the support of John Hepburn and UBC. We are increasing our education budget, and developing a working program with various First Nation communities. This program has been presented to the B.C. government, and has attracted private donors, whom I thank for their generosity. Educating the young is not enough. PIMS has been trying to do so, in three directions: developing mathematical science (creating opportunities for research), creating joint programs with industry (creating added opportunities for research, because of an influx of new mathematical

problems, and also opening up employment opportunities for mathematicians), and creating international programs jointly with foreign institutions (exposing students and young researchers to international standards, and bringing to Canada top-level researchers in fields not represented domestically). Among the major events at the PIMS sites this year, I want to single out PIMS Education Day at the University of Alberta, where the PIMS education prizes were given to Malgorzata Dubiel and Bill Sands; the Graduate Industrial Mathematics Modelling Camp (GIMMC) and Industrial Problem Solving Workshop (IPSW) at Simon Fraser University; and the meeting of the Geophysical Inversion Workshop at the University of Calgary in August, 2006. Our thanks to JF Williams, who was in charge of the IPSW this year, and our best wishes and support to Thomas Hillen, who will organize the IPSW next year.

The Institut des sciences mathématiques (ISM) and the Centre de recherches mathématiques (CRM) have initiated Acromath, a mathematics magazine for high school students, similar to PIMS's Pi in the Sky, and in August, the Fields Institute organized an IPSW with MITACS. The fact that our ideas are taken up by others is a measure of our success, and PIMS has provided Fields with all the help possible for bringing IPSW to Ontario. Our collaborations with Canada's other mathematical institutes extend beyond programme sharing of programme ideas: In May, 2006, I gave the second lecture at CRM's Grande Conference du CRM, Le meilleur des mondes possibles, in Montreal. Not only in industrial initiatives are we leaders: we are also opening up new areas for mathematics away from the classical applications to the natural sciences, and towards the social sciences. As I write these lines, I receive the news that we have received major funding from Alberta Innovation and Science worth \$1.147-million over three years. This is a testimony to the trust that Alberta and its universities put in PIMS and its abilities to enhance the Alberta scientific priorities in the life sciences, energy sector and ICT. We are excited at this prospect, and all the other ones that lie open before us.

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Board of Directors

THE PIMS BOARD OF DIRECTORS IS RESPONSIBLE FOR OVERSIGHT OF ALL ASPECTS OF PIMS. THE BOARD MEMBERSHIP INCLUDES A SENIOR ACADEMIC ADMINISTRATOR FROM EACH OF THE FIVE FOUNDING UNIVERSITIES, THE PIMS DIRECTOR, THREE MATHEMATICAL SCIENTISTS, AND FIVE REPRESENTATIVES FROM THE BUSINESS, INDUSTRY AND RESOURCE SECTORS AND THE PROFESSIONAL SOCIETIES. A STEERING COMMITTEE IS APPOINTED FROM AMONG THE BOARD MEMBERS TO MONITOR THE DAY-TO-DAY OPERATIONS OF PIMS.

Brian H. Russell Chair of the Board (from June, 2005): has spent his career working in all aspects of exploration geophysics. He initially joined Chevron Standard in Calgary in 1976 as a seismic interpreter, subsequently working for Chevron Geosciences in both Calgary and Houston in the areas of seismic processing and research. After leaving Chevron in 1981, Dr. Russell joined Teknica Resources Development in Calgary as a senior geophysicist. In 1983, he moved to Vertias Seismic Ltd. in a research and training position. In 1987, Dr. Russell, together with Dan Hampson, founded Hampson-Russell Software Services Ltd., a company that develops advanced seismic software for the petroleum industry. Since September, 2002, Hampson-Russell has been a wholly owned subsidiary of Veritas DGC Inc., where Dr. Russell is Vice-President.



Dr. Russell is still actively involved in geophysical research and training, and presents courses on seismic technology throughout the world. He holds a B.Sc. Honours in Physics and Geophysics from the University of Saskatchewan and a M.Sc. in Geophysics from the University of Durham, England. He recently completed his Ph.D. in Geophysics at the University of Calgary, where his research involves the application of multivariate statistics and neural networks to the delineation of reservoir parameters using seismic attributes.

Dr. Russell has also been active as a volunteer with several geophysical societies. He was president of the Canadian SEG (CSEG) in 1991, received the CSEG Meritorious Service Award in 1995, the CSEG Medal in 1999, and honorary membership in 2001. With the Society of Exploration Geophysics (SEG), Dr. Russell served as chairman of the Leading Edge editorial board in 1995, technical co-chairman of the 1996 SEG annual meeting in Denver, and as President of

SEG during 1998-99. In 1996, Dr. Russell and Mr. Hampson were jointly awarded the SEG Enterprise Award. He has been a member of the PIMS Board of Directors since 2004, and Chair since June, 2005.

Fernando Aguilar graduated as a Civil Engineer (MS) in Hydraulic Resources Management in 1981, and received his MBA in 1990 from the Universidad de Los Andes in Bogota, Colombia. He has completed the Stanford Executive program at Stanford University in 2003, and the Directors Education Program at the University of Calgary in 2007. With 26 years of worldwide experience on all continents, Mr. Aguilar has held a variety of positions in diversified conglomerates of Schlumberger in various technology, business and oilfield sectors specializing in merging cultures, restructuring and consolidating companies for enhanced results and improved shareholder return. Mr. Aguilar is multilingual in English, French and Spanish. He joined Veritas in September, 2004, in a leadership role of responsibility for Canadian and Latin American operations and business lines. Veritas was subsequently purchased by CGG to form CGGVeritas, a global leading international pure-play geophysical company delivering a wide range of technologies, services and equipment through Sercel, to its broad base of customers mainly throughout the global oil and gas industry. Mr. Aguilar's role is currently Executive Vice-President for Canada Land Processing, Canada Land Library, and Western Hemisphere Land Acquisition with CGGVeritas. Commencing April, 2008, he will assume the new position of President of the Eastern Hemisphere of the corporation. He has been a member of the PIMS Board of Directors since August, 2007.

Dr. Don Brooks received his Ph.D. from the University of Oregon in 1971. He held postdoctoral positions at the Weizmann Institute and the University of Cambridge, before coming to UBC in 1974. Dr. Brooks is professor of Pathology and Laboratory Medicine as well as Chemistry. He is also the Associate Vice-President Research for UBC.



His areas of research are biomaterials, microgravity biotechnology, development of blood plasma substitutes and immunodiagnostic techniques. He has been a member of the PIMS Board of Directors since 2004.

Ivar Ekeland is the Canada Research Chair in Mathematical Economics at the University of British Columbia. He is a former President of Université Paris-Dauphine, and a former Director of the research centres CEREMADE and Institute Finance-Dauphine. He has received prizes from the French Academy of Sciences, the French Mathematical Society, and the Belgian Academy of Sciences. He is a foreign member of the Norwegian Academy of Sciences and he holds honorary doctorates from UBC and from the University of Saint-Petersburg for Economics and Finance. Dr. Ekeland is the founding editor of the “Annales de l’Institut Henri Poincaré-Analyse nonlinéaire” and he sits on the editorial board of many other publications. He has also written several books which are reflections on, or popularization of, mathematics. For these contributions, Dr Ekeland was awarded the “Prix Jean Rostand” by the Association des Ecrivains Scientifiques de France and the “Prix d’Alembert” by the Société Mathématique de France. He is also a regular contributor to the journal “Nature” as well as to the magazine “Pour la Science”. He has been a member of the PIMS Board of Directors since 2003 when he became PIMS Director.



Haig Farris practiced as a lawyer with Farris and Company for five years, then moved into financial consulting, co-founding two companies. He is currently President of Fractal Capital Corp., a private venture capital company specializing in hi-tech start-ups

and resource industry technology companies. In 2001, along with several other UBC graduates, Mr. Farris was named a Pioneer of Innovation by the Vancouver Board of Trade. Also last year, he was awarded the Bill Thompson Career Achievement Award by the British Columbia Technology Industry Association. Mr. Farris has maintained a consistently high profile in the community as an advocate for UBC and as a champion of science and technology. In the latter role, he has been Chair of the Science Council of BC and a member of the founding Board of Directors for Science World, heading its first two capital campaigns. Mr. Farris speaks at many conferences, most frequently on the topic of science awareness, venture investing and the management of high-tech companies. He also shared his accumulation of knowledge through an adjunct professorship at UBC, encouraging entrepreneurship among his students. He currently finances several former students with new technology companies. He was nominated for a UBC Commerce Graduate Teaching Excellence Award in 1996. His UBC degree is in English and Economics, perhaps a reflection of his lifelong interest in the arts as well as in business and the economy. He has served on many community boards, among them the Vancouver Foundation and the Waterfront Theatre. In 1989, he was awarded with the Commemorative Medal of Canada in recognition of his service to the community. Friends laud Mr. Farris’s sense of vision and leadership: he leads by example and is living proof that individual attitudes and behaviour can make a difference. On campus, Mr. Farris served as President of the Alumni Association (1996-1999), is current chair of the President’s Library Advisory Committee, and sits on the Dean of Science and Cecil Green College advisory committees. In 1997, the university awarded him an Honorary Doctor of Laws degree. He has been a member of the PIMS Board of Directors since 2004.

Dr. Gary Kachanoski has been the Vice-President (Research) and Professor (Department of Renewable Resources) at the University of Alberta since August 1, 2001. From 1996-2001 he was Dean, College of Graduate Studies and Research, and Professor at the University of Saskatchewan. He received his BSc (honors Biology 1976) and MSc (Soil Science 1980) from the University of Saskatchewan, and his PhD (Soil Phys-



ics 1984) from the University of California, Davis. At the University of Saskatchewan he was also appointed Dean, Virtual College of Biotechnology, a university-wide initiative to coordinate teaching and research in the social, ethical, legal, commercial, and science issues related to biotechnology. From 1985 to 1996 Gary was at the University of Guelph, finishing his appointment there as Chair, Department of Land Resource Science, and Director of Research (Environment and Natural Resources) in the Vice-President (Research) Office. At Guelph he had significant involvement in the planning, coordination, and transfer of research and technology to industry, government, user groups, and the general public. He was awarded the Distinguished Faculty Extension and Service Award for his work in this area. Gary continues to have a strong research program with main interests in the physics of water and chemical transport through soil. His past research contributions have been recognized by awards such as Fellow of Soil Science Society of America and Fellow of the Canadian Society of Soil Science. He was President of the Canadian Society of Soil Science in 2001. He has served on the Editorial Boards of the top peer reviewed research journals in his field including the Canadian Journal of Soil Science, Soil Science Society of America Journal, and the European Journal of Soil Science. He has authored over 80 scientific papers in referred journals and over 10 book chapters/sections. His research and technology transfer in soil and water conservation work have been recognized by industry and his peers through a nomination and induction into the Canadian Conservation Hall of Fame by Soil Conservation Canada. He has been a member of the PIMS Board of Directors since 2002.

Mark Lewis is a faculty member at the University of Alberta. He is the Senior Canada Research Chair in Mathematical Biology and directs the Centre for Mathematical Biology. Dr. Lewis obtained his doctorate from the University of Oxford in 1990 in Mathematical Biology. He was a faculty member at the University of Utah until 2001, and has also held visiting and research fellowships at Princeton University and Imperial College, University of London. He is Past President of the Society for Mathematical Biology, and is on the editorial boards for a number of journals including Journal of Mathematical Biology, IMA Journal of Mathematic Medicine and Biology, Ecology and Ecological Monographs. Dr. Lewis has served on a number of advisory boards, including the Journal of Theoretical Biology Advisory Board and Scientific Advisory Board for the Banff International Research Station for Mathematical Innovation and Discovery. His research has been recognized by a Sloan Research Fellowship and a National

Young Investigator Award (US NSF). Dr. Lewis's research is in mathematical biology and ecology, including modelling and analysis of nonlinear PDE and integral models in population dynamics and ecology. Applications, made to case studies with detailed data and biology, include: wolf territories, elk migration in Yellowstone Park, spatial spread and impact of introduced pest species, vegetation shift in response to climate change and recolonization of Mount St. Helens. He has been a member of the PIMS Board of Directors since 2004.

Hugh Morris holds a Ph.D. in Mining Geology from the University of Witwatersrand, Johannesburg, South Africa, and has 44 years of experience in the mineral industry. He is a fellow of the Royal Society of Canada and is Chair of the Society's Canadian Global Change Program. From 1962 to 1979 he held a series of positions with Cominco Ltd. in its Exploration and Mining Departments in several Canadian locations, eventually becoming Director of Exploration for its worldwide activities. In 1979, Dr. Morris became associated with the E & B-Geomex Group of affiliated companies in Calgary, initially as President and Chief Operating Officer of Geomex Minerals Ltd., and in 1981, as President and Chief Executive Officer of E & B Canada Resources Ltd. Following the merger of the E & B-Geomex Group and Imperial Metals Corporation of Vancouver in May 1983, he was appointed Chairman and Chief Executive Officer of Imperial Metals and of three public companies within the Imperial Metals Group. He resigned from these positions in February 1993 to pursue other interests. Currently, he is a mineral industry consultant and board member of six Canadian public companies. Dr. Morris has demonstrated special interest in national and international scientific and professional associations. He is a member of NSERC's Council, a member of the Standing Finance committee of ICSU, and Chairman of the Board of Directors of the Lithoprobe Project. He is past-president of the Geoscience Council of Canada, a past-president of the Geological Association of Canada, and was also Treasurer of the Canadian Geological Foundations from 1987 to 1996. He is a member of the Geological Society of London, the Institute of Mining and Metallurgy, U.K., the Canadian Institute of Mining and Metallurgy, a member of the Association of Professional Engineers of British Columbia and a number of other scientific and professional associations. He has been a member of the PIMS Board of Directors since 1997, and he is the former chair of the PIMS Board.

Dr. Dennis R. Salahub assumed the position of is the Vice- President (Research & International) at the University of Calgary on July 1, 2002. Previously, he was the Director General of the Steacie Institute for Molecular Sciences at the National Research Council of Canada in Ottawa, from 1999 until June, 2002. Prior to this he was a Professor of Chemistry at the Université de Montreal from 1976 to 1999, holding a McConnell Chair from 1990. A native of Alberta, Dr. Salahub has been interested in theoretical and computational chemistry since his undergraduate days in Edmonton and his doctorate at the Université de Montreal. Following postdoctoral studies at Sussex, Waterloo, Johns Hopkins and the General Electric laboratories in Schenectady, New York, he returned to the Université de Montreal and set up an internationally recognized research program in quantum chemistry, specializing in the development of Density Functional Theory and its applications in materials and biomolecular modeling. He has published some 250 research papers, four edited books and has delivered more than 300 invited lectures on the national and international scenes. His students are now occupying important positions in academia, industry and government in several countries. The computer code, deMon, developed in his laboratory is used by researchers around the world. Dr. Salahub has served the science and innovation communities on a broad front. He was the Program Leader of the Centers of Excellence in Molecular and Interfacial Dynamics (CEMAID) from 1991 to 1994 and a founding member of the Centre de Recherche en Calcul Appliqué (CERCA) in 1991. He has served on NSERC's Grant Selection Committee and twice on the Reallocation Steering Committee for Chemistry (1997, 2001, Chair). He was the lead applicant for an \$18M Canada Foundation for Innovation grant that brought high-performance computing to Quebec in 1998 and was an early proponent of the c3.ca organization which is fostering high-performance computing and networking in Canada. He has been a consultant for industry and the Steacie Institute is currently fostering several incubation and spinoff companies. At the Steacie Institute, Dr. Salahub shaped research thrusts in nanoscience and technology, bioscience and technology, and optical science and technology, under the banner of the Institute's motto "The fundamental things apply". He contributed to NRC's vision for nanotechnology in Canada and to the founding of the new \$120M National Institute for Nanotechnology in Edmonton, Alberta. Dr. Salahub has been the recipient of a CNC-IUPAC Award, the Noranda Award of the Canadian Society for



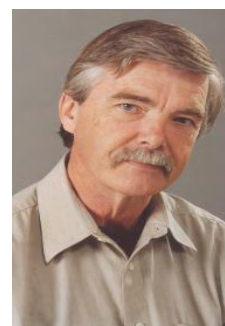
Chemistry and a Killam Research Fellowship. In 1998 he was named as a Fellow of the Royal Society of Canada.

His current term on the PIMS Board of Directors started in 2005, and he also served on the PIMS Board in 2003-04.

Dr. Martin Taylor moved to UVic in July 1998 to be the University's first Vice-President Research as well as being a full professor in the Geography Department. He has a BA in Geography from the University of Bristol (UK), and an MA and PhD from the University of British Columbia. He was appointed at McMaster in 1971. He was Chair of Geography (1991-1997), founding Director of the Institute of Environment and Health (1991-1996), and Acting Vice President Research (1994-1995). His research and teaching interests focus on environmental health and health promotion issues. His ongoing projects include research on the psychosocial effects of environmental contaminants and on community-based health promotion. He has authored one book and over 100 papers in peer-reviewed journals. He has been a member of the PIMS Board of Directors since 1998.



Dr. Hugh Williams holds the iCORE Chair in Algorithmic Number Theory and Computing at the University of Calgary and is a professor in the Mathematics and Statistics Department at that Institution. His main research interests are in computational number theory, cryptography and the design and development of special-purpose hardware devices. His work in computational number theory extends from analyzing the complexity of number theoretic algorithms to the actual implementation and testing of such algorithms. Dr. Williams has published more than 130 refereed journal papers, 20 refereed conference papers and 20 books or (chapters therein). From 1983-1985, he held a national Killam Research Fellowship. He has been an associate editor for Mathematics of Computation since 1978 and is also a member of the editorial boards of two other journals. Dr. Williams has also served on the Natural Science and Engineering Research Council (NSERC) Grant Selection Committees for both Computing and Information Science (1972-1975) and Pure and Applied Mathematics (1991-1994), and chaired the latter from 1993-1994. He has also been a member of the Steacie Awards Selection Committee. He has been a member of the PIMS Board of Directors since 2004.



Scientific Review Panel

SCIENTIFIC ACTIVITIES OF THE PACIFIC INSTITUTE FOR THE MATHEMATICAL SCIENCES ARE REVIEWED BY AN ARM'S-LENGTH SCIENTIFIC REVIEW PANEL (SRP) OF EXPERTS FROM VARIOUS FIELDS OF THE MATHEMATICAL SCIENCES. THE SRP MEETS ONCE A YEAR TO MAKE RECOMMENDATIONS TO THE BOARD ON THE SELECTION OF UPCOMING SCIENTIFIC ACTIVITIES.

Ivar Ekeland is the Canada Research Chair in Mathematical Economics at the University of British Columbia. He is a former President of Université Paris-Dauphine, and a former Director of the research centres CEREMADE and Institute Finance-Dauphine.

He has received prizes from the French Academy of Sciences, the French Mathematical Society, and the Belgian Academy of Sciences. He is a foreign member of the Norwegian Academy of Sciences and he holds honorary doctorates from UBC and from the University of Saint-Petersburg for Economics and Finance.

Dr. Ekeland is the founding editor of the "Annales de l'Institut Henri Poincaré-Analyse nonlinéaire" and he sits on the editorial board of many other publications.

He has also written several books which are reflections on, or popularization of, mathematics. For these contributions, Dr. Ekeland was awarded the "Prix Jean Rostand" by the Association des Ecrivains Scientifiques de France and the "Prix d'Alembert" by the Société Mathématique de France. He is also a regular contributor to the journal "Nature" as well as to the magazine "Pour la Science".

He has been a member of the PIMS SRP since 2003.

Alejandro Adem is a Professor of Mathematics at UBC. In 1982 he received his B.S. from the National University of Mexico, and in 1986 he received his Ph.D. from Princeton University, under Bill Browder. After holding a Szegő Assistant Professorship at Stanford University and spending a year at the Institute for Advanced Study in Princeton, he joined the faculty of the University of Wisconsin in 1990, and remained there until he joined the University of British Columbia in 2004. Dr. Adem has held visiting positions at the ETH-Zurich, the Max Planck Institut in Bonn, the University of Paris VII and XIII, and most recently at Princeton University.

Dr. Adem's mathematical interests vary widely over topics in algebraic topology, group cohomology and related areas. He has given over 150 invited lectures; however, his toughest assignment was preparing a lecture for the celebrated Bourbaki Seminar in Paris. His monograph "Cohomology of Finite Groups" (jointly written with R. James Milgram) was published as a Springer-Verlag Grundlehren (Volume 309) in 1994, and a second edition appeared in 2005.

Dr. Adem served as Chair of the Department of Math-

ematics at the University of Wisconsin-Madison, during the period 1999-2002. He was awarded an NSF Young Investigator Award in 1992, a Romnes Faculty Fellowship in 1995 and a Vilas Associate Award in 2003. He is an editor for the Transactions of the American Mathematical Society. He is currently co-chair of the Scientific Advisory Committee for the Mathematical Sciences Research Institute in Berkeley.

In 2004, Dr. Adem was appointed Canada Research Chair in Algebraic Topology at UBC and, on January 1, 2005, he became the Deputy Director of PIMS. He has been an ex-officio member of the PIMS SRP since 2005.

Anne Condon is a Professor in the Department of Computer Science at the University of British Columbia and is the NSERC/General Motors Chair for Women in Science and Engineering for British Columbia and Yukon. She received her Ph.D. (1987) from the University of Washington, and B.Sc. (1982) from University College, Cork, Ireland. Her Ph.D. thesis on game-like computational models won an ACM Distinguished Dissertation award. She also received an NSF National Young Investigator Award (1992) and an NSF Visiting Professorships for Women Award (1996) to support her work.

Dr. Condon's research focuses on the power of randomness in computation. Through classification of randomized and nondeterministic complexity classes, her work has led to improved understanding of what types of intractable problems can be approximated and/or computed efficiently, notably PSPACE-hard problems and also problems in probabilistic planning. Dr. Condon also works on computational prediction of RNA secondary structure, and on verification of cache coherence protocols.

She has been a member of the PIMS SRP since 2005.

Carl de Boer is a Professor Emeritus in Mathematics and Computer Science at the University of Wisconsin-Madison. He won the 2003 U.S. National Medal of Science. An expert in numerical analysis, Dr. de Boer is the author of more than 150 papers and four books. He has earned world recognition for his work on spline functions, mathematical expressions that describe free-form curves and surfaces. In particular, Dr. de Boer developed simpler approaches to complex

spline calculations, a contribution that revolutionized computer-aided geometric design. His work is now routinely applied in a range of fields that rely on precise geometry, including the use of special effects in films, and in the aircraft and automotive industries.

Dr. de Boor grew up in East Germany and came to the United States in 1959. He received a doctorate from the University of Michigan in 1966 and joined the University of Wisconsin-Madison faculty in 1972. Until 2003, Dr. de Boor was the Steenbock Professor of Mathematical Sciences and the P.L. Chebyshev Professor of Mathematics and Computer Sciences. He was awarded the John von Neumann Prize by SIAM in 1996. In 1993 he was elected to the National Academy of Engineering, and in 1997 to the National Academy of Sciences. Dr. de Boor is a member of the Deutsche Akademie der Naturforscher (1998) and a foreign member of the Polish Academy of Sciences (2000). He holds honorary doctorates from Purdue University (1993) and the Technion in Israel (2002).

He has been a member of the PIMS SRP since 2005.

John Friedlander is one of the world's foremost analytic number theorists, and is a recognized leader in the theory of prime numbers and L-functions. He received his B.Sc. from the University of Toronto in 1965, an M.A. from the University of Waterloo in 1966, and a Ph.D. from Penn State in 1972. He was a lecturer at MIT in 1974-76, and has been on the faculty of the University of Toronto since 1977, where he served as chair during 1987-91. He has also spent several years at the Institute for Advanced Study where he has collaborated with E. Bombieri and many others.

Dr. Friedlander is a Fellow of the Royal Society of Canada (1988), an invited lecturer at the 1994 ICM in Zurich, and he delivered the CMS Jeffery-Williams Lecture in 1999. He has contributed significantly to mathematics in other ways, especially in Canada, through his role at NSERC (Mathematics GSC, 1991-94), as Mathematics Convenor of the Royal Society of Canada (1990-93), and as a Council Member (1989-95) and Scientific Advisory Panel Member (1996-2000) of the Fields Institute. He has served on the Editorial Board of the Canadian Journal of Mathematics and the Canadian Mathematics Bulletin.

He has been a member of the PIMS SRP since 2005.

R.G. (Randy) Goebel is currently professor and chair in the Department of Computing Science at the University of Alberta. He received the B.Sc. (Computer Science) from the University of Regina, M.Sc. (Computing Science) from the University of Alberta, and Ph.D. (Computer Science) from the University of British Columbia.

Dr. Goebel's research is focused on the theory

and application of intelligent systems. His theoretical work on abduction, hypothetical reasoning and belief revision is well known, and his recent application of practical belief revision to scheduling and web mining is now having industrial impact.

He has been a member of the PIMS SRP since 2002.

Ian F. Putnam received his Ph.D. from the University of California at Berkeley in 1985. He was an NSERC University Research Fellow at Dalhousie University before moving to the University of Victoria where he is currently Canada Research Chair in Operator Algebras and Dynamical Systems in the department of mathematics and statistics. He has received the Israel Halperin Prize and the André Aisenstadt prize. He is a Fellow of the Royal Society of Canada.

He has been a member of the PIMS SRP since 1999.

Nancy Reid is University Professor of Statistics at the University of Toronto. She received her Bachelor of Mathematics in 1974 from the University of Waterloo, her M.Sc. in 1976 from the University of British Columbia, and her Ph.D. in 1979 from Stanford University. She held an academic appointment at the UBC from 1980-86 and has held visiting appointments at Imperial College, London, Harvard University and the University of Texas at Austin. She has served as President of the Institute of Mathematical Statistics and of the Statistical Society of Canada; and as Vice-President of the International Statistical Institute.

Dr. Reid is a fellow of the Royal Society of Canada, the American Statistical Association and the Institute of Mathematical Statistics, a recipient of the Presidents' Award of the Committee of Presidents of Statistical Societies, the first recipient of the Canadian Mathematical Society's Krieger-Nelson Prize Lectureship, and the Institute of Mathematical Statistics' Wald lecturer for 2000. Her research interests include inferential statistics with special emphasis on asymptotic theory for likelihood based inference, design of experiments, and applications of statistics to health and environment.

She has been a member of the PIMS SRP since 2005.

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 Professor in 1981. He has held numerous visiting positions throughout the world, including at Stanford, University of Auckland and Imperial College (as an SERC Fellow).

Dr. Russell's travels include serving as an Invited Scholar at the USSR and Chinese Academies of Science and as a plenary speaker at SIAM's Dynamical Sys-

tems 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.

His field of research is scientific computing, with special emphasis on the numerical solution of PDEs and ODEs. He is particularly interested 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. He has been a member of the PIMS SRP since 2002.

Donald Saari is a Distinguished Professor of Mathematics and of Economics as well as the Director of the Institute for Mathematical Behavioral Sciences at the University of California at Irvine. He received his undergraduate degree from Michigan Technological University and his Ph.D. from Purdue University under advisor Harry Pollard, where his thesis discussed the collision dynamics of the Newtonian N-body problem. After a postdoctoral position in the Yale University Astronomy Department, he joined the Mathematics Department at Northwestern University where he served as chair of the department and was the first Pancoe Professor of Mathematics. After three decades at Northwestern, in July 2000, he moved to California.

Dr. Saari's research interests centre on dynamical systems and their applications to mathematical physics (primarily the Newtonian N-body problem) as well as to mathematical issues from the social sciences coming from economics, voting theory, and evolutionary behaviour. He is the Chief Editor of the "Bulletin of the American Mathematical Society" as well as serving on the editorial boards of several journals on analysis, dynamics, economics, and decision analysis. He is a member of the National Academy of Sciences and the American Academy of Arts and Sciences, a Guggenheim Fellow, the past chair of the U.S. National Committee of Mathematics, chair of the U.S. delegation to the 2002 general assembly of the International Mathematical Union, and a member of several NRC committees including Math Science Education Board. He has been a member of the PIMS SRP since 2005.

Gang Tian received his Ph.D. from Harvard University in 1988. After positions at Princeton University and the State University of New York at Stony Brook, he went to the Courant Institute of Mathematical Sciences at New York University in 1991 as an Associate Professor and became a Professor in 1992. He is currently a J. Simons Professor at the Massachusetts

Institute of Technology. Dr. Tian is a recipient of the Alfred P. Sloan research fellowship (1991-93). He presented a 45-minute invited address at the International Congress of Mathematicians in Kyoto in 1990 and a plenary address at the International Congress of Mathematics in Beijing in 2002. In 1994, he received the 19th Alan Waterman Award from the National Science Foundation. In 1996, Dr. Tian received the Veblen Prize of the American Mathematical Society. He has been a member of the PIMS SRP since 2002.

Tatiana Toro received her Ph.D. from Stanford University in 1992. Since 1996 she has been at the University of Washington where she became a Professor in 2002. She has held positions at Harvard University, the University of Chicago, and the University of California-Berkeley. From 1996-2000, she held a Alfred P. Sloan Research Fellowship, and from 1994-98 she held an NSF Mathematical Sciences Postdoctoral Research Fellowship.

Dr. Toro's research areas include geometric measure theory and partial differential equations. She applies techniques from these two fields to study free boundary regularity problems with very rough boundary data. These problems arise naturally in physics and engineering, where the free boundary may appear as the interface between a fluid and the air, or water and ice. She has also worked in the problem of constructing good parameterization for sets satisfying some minimal geometric requirements (for example: snowballs). She has been a member of the PIMS SRP since 2005.

Gunther Uhlmann received his Ph.D. in 1976 at MIT under the direction of Victor Guillemin. He held postdoctoral positions at Harvard, Courant Institute and MIT. In 1980 he became Assistant Professor at MIT and in 1985 he moved to the University of Washington as an Associate Professor. He was promoted to Professor in 1987.

Dr. Uhlmann was awarded the Annual National Prize of Venezuela in Mathematics in 1982. He received an Alfred P. Sloan Research Fellowship in 1984 and a John Simon Guggenheim Fellowship in 2001. He has given numerous lectures throughout the world including an invited address at the Portland meeting of the AMS in 1991, the CBMS-NSF lectures on "Inverse Problems and Non-Destructive Evaluation" in 1995, an invited lecture at the International Congress of Mathematicians in Berlin in 1998, and the PIMS Distinguished Lectures at UBC in 2002.

His current interest is inverse problems; in particular inverse boundary value problems and inverse scattering problems. In these problems, one attempts to determine internal parameters of a medium by making measurements at the boundary of the medium or by remote observations. He has been a member of the PIMS SRP since 2002.

Hugh Williams holds the iCORE Chair in Algorithmic Number Theory and Computing at the University of Calgary and is a Professor in the Mathematics and Statistics Department. His main research interests are in computational number theory, cryptography and the design and development of special-purpose hardware devices. His work in computational number theory extends from analyzing the complexity of number theoretic algorithms to the actual implementation and testing of such algorithms.

Dr. Williams has published more than 130 refereed journal papers, 20 refereed conference papers and 20 books or chapters therein. From 1983-85, he held a national Killam Research Fellowship. He has been an associate editor for *Mathematics of Computation* since 1978 and is also a member of the editorial boards of two other journals.

Dr. Williams has also served on the Natural Science and Engineering Research Council (NSERC) Grant Selection Committees for both Computing and Information Science (1972-75) and Pure and Applied Mathematics (1991-94), and chaired the latter from 1993-94. He has also been a member of the Steacie Awards Selection Committee.

He has been a member of the PIMS SRP since 2002.

Efim Zelmanov is the Rita L. Atkinson Chair in Mathematics at the University of California, San Diego. He attended Novosibirsk State University, obtaining his Ph.D. in 1980 having had his research supervised by Dr. Shirshov and Dr. Bokut. His Ph.D. thesis completely changed the whole of the subject of Jordan algebras by extending results from the classical theory of finite dimensional Jordan algebras to infinite dimensional Jordan algebras. Dr. Zelmanov described this work on Jordan algebras in his invited lecture to the International Congress of Mathematicians at Warsaw in 1983.

In 1980, Dr. Zelmanov was appointed as a Junior Researcher at the Institute of Mathematics of the Academy of Sciences of the USSR at Novosibirsk. By 1986 he had been promoted to Leading Researcher. In 1987 Zelmanov solved one of the big open questions in the theory of Lie algebras. He proved that the Engel identity $\text{ad } y(n) = 0$ implies that the algebra is necessarily nilpotent. This was a classical result for finite dimensional Lie algebras but Dr. Zelmanov proved that the result also held also for infinite dimensional Lie algebras. In 1990, Dr. Zelmanov was appointed a Professor at the University of Wisconsin-Madison. He held this appointment until 1994 when he was appointed to the University of Chicago. In 1995, he spent the year at Yale University.

In 1991, Dr. Zelmanov went on to settle one of the most fundamental results in the theory of groups: the restricted Burnside problem, which had occupied group theorists throughout the 20th century. In 1994, Dr. Zelmanov was awarded a Fields Medal for this

work at the International Congress of Mathematicians in Zurich in 1994. He is also a recipient of an André Aisenstadt Prize and a College de France Medal. He is a Fellow of the American Academy of Arts and Sciences and a Member of the National Academy of Sciences.

He has been a member of the PIMS SRP since 2005.

PIMS Partnerships (News)

We held a joint PIMS/UNAM Algebra Summer School at Banff in July, 2006, and with CMM we co-organized the PIMS Frontiers in Mathematics and Economics Summer School, held at UBC in July, 2006. A second joint meeting with CMM, on the mathematics of mining, is planned for next February in Santiago. An important development arising from our engagement with the Mexican mathematical community is the first joint meeting of the Canadian Mathematical Society and the Sociedad Matemática Mexicana, which will take place in Guanajuato, Mexico, in September, 2006. As for the Pacific Rim, PIMS co-sponsored (together with MSRI) the establishment of the Pacific Rim Mathematical Association (PRIMA), which is a network of mathematical institutes, departments and societies throughout the region, seeking to promote collaboration and mobility.

As part of this initiative the Director and Deputy Director of PIMS traveled to China, establishing important contacts with several universities there, as well as with the National Natural Science Foundation of China. These exciting developments have made PIMS a leader in international networking among North American mathematical institutes and will surely lead to significant new developments in the near future.

As a result of the Natural Resources and Mathematical Economics meeting, organized by the CMM and PIMS at the Banff International Research Station from Nov. 26 to Dec. 1, 2005, both centres have decided to promote the organization of a workshop in Rock Mechanics and Planning in Mining in Santiago, from Feb. 26 to March 2, 2007, jointly with the centres of excellence in Australia, Canada and Germany: MASCOS, MATHEON and MITACS. This meeting is a starting point for a wider and more fruitful collaboration among these centres, which share common goals. In 2006, PIMS and CMM jointly held a Summer School on Frontiers of Mathematics and Economics from July 10-31 at UBC. The two institutes are also planning a workshop on the structural equations of rocks, and PDE problems connected with mining. We hope that, as our cooperation develops,

PIMS will see a steady flow of researchers and graduate students from CMM and the whole of Latin America. In 2006, PIMS signed separate working agreements with two Mexican institutes, the Mathematics Institute at UNAM (March, 2006) and CINVESTAV (September, 2006). This has resulted in closer ties between the Canadian and Mexican mathematical communities (the first joint meeting of the Canadian and Mexican societies was held in Guanajuato in September, 2006, and the second one is scheduled in Vancouver in 2009).

SCIENTIFIC ACTIVITIES

PIMS 10th ANNIVERSARY SPEAKERS

John Taylor (University of Montreal),
Sept. 28, 2006
The Integral Geometry of Random Sets

Andrei Okounkov (Princeton University),
Oct. 16, 2006
Frozen Boundaries and Log-Fronts

Helmut Hofer (Courant Institute, NYU)
Oct. 23, 2006
New Geometric and Functional Analytic Ideas
Arising from Problems in Symplectic Geometry

Gregory Lawler (University of Chicago)
Oct. 24, 2006
Conformal Invariance and Two-Dimensional
Statistical Physics

Robert J. Adler (Technion, Israel) Oct. 25, 2006
The Brain, the universe, and random processes
on Manifolds

Peter Bickel (UC Berkeley)
Oct. 30, 2006
Regularized Covariance Matrix Estimation

Raman Parimala (Tat Institute) Oct. 30, 2006
Sums of Squares and Pfister Forms

James Arthur (University of Toronto), Nov. 6,
2006
A History of the Trace Formula

Richard Howitt (UC Davis) Nov. 10, 2006
A Computational Economics Approach to Policy
Models: Applications to Natural Resources

Alexander Razborov (IAS) Nov. 10, 2006
Feasible Proofs and Computations

Bin Yu (UC Berkeley) Nov. 20, 2006
Feature Selection Through Lasso: Model Selection
Consistency and the BLasso Algorithm

Garrett Odell (University of Washington)
Nov. 27, 2006
For Making Genetic Networks Operate Robustly,
unintelligent non-Design suffices

Mark Lewis (University of Alberta) Dec. 4, 2006
Plagued by Numbers: The Mathematics of Disease

Karlheinz Groechenig (University of Vienna)
Dec. 7, 2006
Time-Frequency Analysis: From Wireless Communications to Abstract Harmonic Analysis

Stephen Smale (Toyota Technology Institute)
Jan. 9, 2007
Topology, Data and Vision
Jan. 10, 2007
Emergence and Flocking

Klaus Schmidt (University of Vienna)
Jan. 11, 2007
On Some of the Differences Between Z and Z^2 in
Dynamics.

Jim Zidek (UBC) Jan. 29, 2007
Statistical Modeling in Setting Air Quality Standards

Jesper Lutzen (University of Copenhagen)
Feb. 5, 2007

Jerry Sacks (National Institute of Statistical Sciences)
Feb. 19, 2007

Gary Neal (UC Santa Barbara) Feb. 26, 2007
Computational Studies of the Motion of a nematic
LCP in a Simple Shear Device

James Berger (Statistical & Applied Mathematics
Institute) Mar. 19, 2007

Nancy Reid (University of Toronto) Mar. 26,
2007
The Interface Between Bayesian and Frequentist
Statistics

Alexander Merkurjev (UC Los Angeles)
Mar. 29, 2007

Collaborative Research Groups

The PIMS Collaborative Research Groups (CRG) consist of researchers with a common research interest, and with a common desire to collaborate and develop some aspects of their research programmes. Groups may be organizing joint seminars and workshops, making joint PDF appointments, or developing joint graduate training programmes. However, with the resources and organizational structure of PIMS CRGs, they can do considerably more.

The CRGs act as a vehicle for networking between universities. They effectively integrate the mathematical sciences community at the various PIMS universities into the scientific infrastructure of PIMS. They build on already existing joint efforts and links between the researchers of Western Canada and the Pacific Northwest, opening up a new era of scientific collaborations between the two countries.

The CRGs create critical mass that substantially enhances training programmes at all levels. The pooling of PIMS support with other sources and the joint planning of resource allocation allows the CRGs to support a large number of PDFs and graduate students, and creates new research opportunities for these young scientists, including exchanges, joint supervision and summer schools.

The CRGs directly address the problems of retention and recruitment of faculty. They are a venue for new faculty to enter into a larger community, they give young faculty an effective network to build their research programme, and they enhance the attractiveness of the universities.

PIMS has identified 32 potential CRGs within its community, spanning five broad areas of research to which PIMS is committed: Fundamental Mathematics, Applied and Computational Mathematics, Mathematical Biology and Medicine, Statistical Sciences and Theoretical Computer Science. While some are already well established and structured, in most cases they are just forming. Each CRG, which usually consists of 10–15 researchers, are to be jointly coordinated by at least three senior researchers representing various PIMS sites.

PERIODS OF CONCENTRATED ACTIVITIES FOR THE CRGs

The Periods of Concentration (POC) are designed to promote and support longer term, multi-event, multi-site coordinated activities of competitively selected CRGs, in tandem with their national and international collaborators and visitors. Every year, the PIMS Scientific Review Panel selects, on a competitive basis, proposed POCs. The selected areas will be the focus of much of the institute's programme over a one- to two-year period of concentrated activities that will be delivered through the selected CRGs. At any given time, it is expected that between five and eight 8 CRGs will lead the PIMS scientific enterprise. Proposals can vary greatly according to the needs of the particular group and may combine a number of existing PIMS activities. During its period of concentration, a CRG can expect to receive priority for:

- PIMS postdoctoral fellowships
- Pacific Northwest seminar series
- Workshops and conferences at PIMS sites
- Intensive graduate courses
- Distinguished chairs and long-term visitors
- Graduate students exchanges
- Graduate and senior undergraduate schools
- Industrial training camps
- International collaborations

With this support, a CRG can gather a significant portion of the world's experts in its scientific area of research for periods of intense collaboration. The fruits of such intensity can be expected to persist for many years and to be exponentially greater than the results of more normal activity levels.

Each CRG must have significant participation and leadership from at least two Canadian PIMS universities. Each CRG will designate a coordinator for its period of concentration. This coordinator must be based at a Canadian PIMS university; she/he will co-ordinate the various CRG activities, approve all CRG events, and will be the CRG's liaison with the PIMS scientific and administrative personnel.

Each CRG designs its activities according to its specific needs within the guidelines provided by PIMS. Facilitating the training of highly qualified personnel has been identified as a priority for PIMS. CRGs are encouraged to take full advantage of the opportunities provided through the PIMS Postdoctoral Fellowship programme, and to take a leadership role in the training of graduate and senior undergraduate students. PIMS encourages CRGs to develop innovative programmes in

consultation with the Deputy Director.

CRGs have priority access to the PIMS PDF programme. Individual PDF applications have to be submitted to the local PIMS site as part of the regular PIMS PDF competition.

In due course, all 32 of the PIMS CRGs recognized so far will be given the benefit of a period of concentration. This approach should dramatically increase the effectiveness of the PIMS research programme by making its facilities and its opportunities available to all CRGs on a periodic basis.

EXPECTED IMPACT OF THE PERIODS OF CONCENTRATION

A targeted and coordinated, yet inclusive grass-roots approach of this form, will present a new and innovative way for the institute to drive and stimulate research and will result in a significant impact on the research excellence of its activities. The programme's extended time scale, its multi-event nature and its cross-university character together distinguish it from any other institute programme. Its implementation will allow PIMS to achieve several of its goals. It will:

- **Provide new ways of having its scientific programmes driven by its member scientists:** The programme will help elicit proposals for thematic summers, mini-programmes, BIRS events, and distinguished scholars as part of the application process. These programmes will have strong local interest and will encourage grass-roots generation and long-term planning of activities with a much more inclusive and flexible format than standard thematic programmes.
- **Foster multi-site interactions and collaborations:** The programme will continue to build the inter-site collaborative nature of the PIMS community and will alleviate the problems of interconnection inherent in large geographical separations between the PIMS sites. It creates a context through which researchers can collectively profit from the opportunities created by the PIMS network.
- **Create new research opportunities and enhance training:** The periods of concentration allow for the planning of a series of advanced graduate courses at any one site with the participation of students from multiple PIMS universities. The Western Dean's Agreement allows graduate students at any Western Canadian university to take courses, for credit, at any Canadian PIMS university. The result is new opportunities for PIMS graduate students and a larger audience for PIMS and visiting scientists. This leads directly to a vigorous graduate student exchange programme.
- **Support existing collaborative research groups and foster new groups:** The periods of concentration help to strengthen groups and give them a vehicle for long-range planning of research and advanced education activities. As well, the CRGs will encourage and empower isolated groups or smaller ones at one university by bringing them into larger collaborative teams.
- **Effectively facilitate Canada-U.S. collaborations:** The programme effectively integrates the mathematical sciences community at the University of Washington into the operations of the institute. It allows groups of Canadian and U.S. researchers develop their collaborative activities, and allow other groups to launch new types of activities. The programme will also provide researchers with the means to play a leadership role on the national and international level.
- **Attract additional support for research:** Periods of concentration provide departments and universities with a mechanism for granting teaching and administrative releases to the scientists involved. Such programmes can also be developed in collaboration with other organizations and institutes, hence multiplying the opportunities.

Algebraic Geometry, Cohomology, and Representation Theory

2005-07

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 the discipline's 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.

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.

The PIMS CRG has many people working in 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.

CRG LEADERS:

Arturo Pianzola (Alberta), Jim Bryan (UBC), Nils Bruin (SFU), Imin Chen (SFU), Xi Chen (UofA), Gerald Cliff (UofA), Vladimir Chernousov (UofA), Terry Gannon (UofA), Jim Lewis (UofA), Arturo Pianzola (UofA), Alejandro Adem (UBC), Kai Behrend (UBC), Jim Bryan (UBC), Jim Carrell (UBC), Bill Casselman (UBC), Kalle Karu (UBC), Dale Peterson (UBC), Zinovy Reichstein (UBC), Clifton Cunningham (UofC), Eric Babson (UofW), Sara Billey (UofW), Chuck Doran (UofW), Arner Iqbal (UofW), Sandor Kovacs (UofW), Paul Smith (UofW), Rekha Thomas (UofW), James Zhang (UofW)

CRG DISTINGUISHED CHAIR

Michael Thaddeus (Columbia University): September 2005-August 2006

CRG VISITORS

P. Gille (CNRS, Universite Paris-Sud), D. Harari (ENS Paris), Canon Leung (University of Science and Technology, Hong Kong), D. Maulik (Princeton), Jan Minac (U. Western Ontario), M. Roth (Queens), S. Smith (U. Illinois at Chicago), G. Soifer (Bar - Ilan University, Ramat Gan, Israel), O. Mathieu (University of Lyon I, France), M. S. Raghunathan (Tata Institute of Fundamental Research, Mumbai, India), I. Panin (Steklov Institute, S. Petersburg, Russia), Yongbin Ruan (Wisconsin-Madison), August 2-5 2005, UBC
Steven Mitchell, Feb 22, 2006
Ching-Li Chai, March 7-10, 2006
K. Zainoulline (Bielefeld University, Germany), March 2006

SCIENTIFIC ACTIVITIES

BAGS: Bellingham Algebraic Geometry Seminar, Feb. 25, 2006, Bellingham, Washington

Alberta- British-Columbia Algebra Workshop, April 8-9, 2006, UBC

Motive and Period, June 5-12, 2006, UBC

PIMS/UNAM Summer School July 1-6, 2006 Banff, AB

Moduli Spaces and Combinatorics July 22-27, 2006 Banff, AB

Algebraic Groups, Quadratic Forms and Related Topics, Sept. 2-7, 2006 Banff, AB

Inverse Problems

2005-07

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 mathematical 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 their reflections measures 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 Earth'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 geophysical inversion technique. Seismic imaging creates images of the Earth's upper crust using seismic waves generated by artificial sources and recorded into extensive arrays of sensors (geophones or hydrophones). The technology 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 inverse 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 nondestructive 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 modeling of the inverse problem as well as in finding reconstruction algorithms.

Bring 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. Physical situations indicated above are modeled 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 has produced significant advances.

CRG leaders : Gary Margrave (U. Calgary), Gunther Uhlmann (U. Washington)

CRG FACULTY

Joel Feldman (UBC), Richard Froese (UBC), Nassif Ghoussoub (UBC), Paul Binding (UofC), Peter Gibson (UofC), Michael Lamoureux (UofC), Peter Lancaster (UofC), Larry Lines (UofC), Jędrzej Sniatycki (UofC), Tony Ware (UofC), Ken Bube (UofW), Edward Curtis (UofW), James Morrow (UofW), John Sylvester (UofW)

SCIENTIFIC ACTIVITIES

Lecture Series on Mathematics of Seismic Imaging, William Symes, Rice University, July 19-20, 2005, at the University of British Columbia

PIMS-MITACS-VIGRE Summer Graduate School on Inverse Problems, August 1-5, 2005, at the University of Washington

Seismic Imaging Summer School, August 7-11, 2006, at the University of Calgary

Geophysical Inversion Workshop, August 14-18, 2006, at the University of Calgary

BIRS Workshop on Inverse Problems and Applications, August 19-24, 2006

Quantum Topology

2005-07

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, in topology, in black hole physics and string theory, and in 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 Environments and Decoherence
7. Spin Nets of Qubits

CRG Leaders: Philip Stamp (UBC), Boris L. Spivak (U. Washington), and Joel Feldman (UBC)

CRG FACULTY

UBC: Ian K. Affleck, Mona Berciu, Joel Feldman, George A. Sawatzky, Philip Stamp

U. Alberta: Frank Marsiglio

U. Calgary: Richard E. Cleve, John Watrous

SFU: Igor Herbut

U. Washington: Boris L. Spivak

Others:

M. Freedman (Microsoft Research), A. Kitaev (Caltech), C. Bourbonnais (Sherbrooke), D. Senechal (Sherbrooke), A. M. Tremblay (Sherbrooke), R. Gill (Utrecht), R.B. Laughlin (Stanford), A.J. Leggett (Urbana), S. Popescu (Bristol, UC Berkeley), P.B. Wiegmann (U Chicago), S.C. Zhang (Stanford), C. Nayak (UCLA)

The Economics and Finance of Climate Risk and Natural Resources 2006-2008

There is significant research in mathematical economics in Western Canada; however, this research has no supporting network. The goal of this CRG is to promote interdisciplinary co-operations among Canadian experts in Mathematics, finance, economics and econometrics, and to establish an internationally visible network of academic excellence in mathematical economics. To this end, the aim of this CRG is to organize a two-year concentration period on the Economics and Finance of Climate Risk and Natural Resources starting September 2006.

This includes a variety of training and research opportunities.

- Hedging and Insurance of Climate and Energy Risk
- Mathematics of Economic Geography and Resource Management
- Contract Theory
- Numerical Methods for Partial Differential Equations

As this includes the numerical analysis of equilibrium, Numerical Methods for Partial Differential Equations constitute the fourth focal point of our research.

The analysis of the economic and financial risk associated with climate change has one of the most active and challenging fields of research for mathematicians and economists. However, a unified framework for managing and hedging these risks has not yet been established. Our research project is related to the management of those risks. We focus on three specific topics. The first (Hedging and insurance of climate and energy risk) deals with the issue of pricing and hedging of insurance contracts written on nonfinancial risk factors such as climate phenomena. In the second approach we question how a well established line of research in economic (economic geography) could help in addressing the issues of managing climate risks and natural resources. In the third approach (contract theory), we address the issue of how to design financial and insurance contracts (or securities) to enhance the risk sharing. We believe that these topics, and their interplay, do not only fit well into our own research agenda, but will also attract the interest of many other scientists at PIMS universities.

CRG LEADERS:

Arthur Robson (SFU), Abel Cadenillas (UofA), Ulrich Horst (UBC), Tony Ware (UofC), Cornelius van Kooten (UVica), Alejandro Jofré (Universidad de Chile)

SCIENTIFIC ACTIVITIES:

Summer School on Frontiers in Mathematics and Economics, July 10-28, UBC

Roch Mechanics and Planning in Mining Workshop, February 26 - March 2, 2007, Chile

Summer School on Mathematical Modelling of Climate and Energy Risk, April 29 to May 13, 2007, at BIRS

PIMS DISTINGUISHED CHAIRS AND VISITORS

Pierre-Andre Chiappori

(Economics, Columbia University) UBC, May 8-14, 2006

Jean-Charles Rochet (Institute d'Economie Industrielle, Universite de Toulouse) UBC, July 10, 2006

“Dynamic Contract Theory and Corporate Finance”

R.T. Rockafeller (University of Washington) UBC, July 10-17, 2006 “Duality and Equilibrium”

Ken Judd (Hoover Institution) UBC) July 10-17, 2006 “Computational Methods in Economics”

Roger Guesnerie (College de France, Paris) UBC, April 23-29, 2007

Mathematical Modelling and Computation in Biology 2006-2008

The primary focus of this CRG is mathematical modelling driven by biological applications. The goal is to promote research and cooperation both within specific research areas and across different areas of applications. This CRG proposed three themes, focuses on the interests of the team members as well as emergin opportunities for research at the mathematics-biology interface:

- Infectious Diseases
- Cellular Mechanics and Dynamics
- Fundamental Applied Mathematics in Biology

In keeping with the interedisciplinary nature of the rapidly developing field of Mathematical Biology and the specific areas listed above, this CRG provides avenues for interaction between theoretical, clinical and experiemental researchers, something not always feasible in the context of large discipline-focused national and international society meetings. In addition, and arguably fundamentally important to the continuation of this valuable trend of cross fertilization, it will give young mathematicians (undergraduate and graduate students, postdoctoral fellows) an opportunity to interact with theoreticians involved in experimental collaborations as well as with experiementalists themselves. This kind of interaction is a crucial step in interdisciplinary career development, one that is rarely available to students due to the departmentally focused nature of most educational training programs.

CRG LEADERS:

Eric Cytrynbaum (UBC), Daniel Coombs (UBC), Rachel Kuske (UBC), Pauline van den Driessche (UVic), Eirikur Pals-son (SFU), Ed Munro (UW).

POST-DOCTORAL FELLOW: Peter Borowski

SCIENTIFIC ACTIVITIES:

Bridging the Scales of Disease Dynamics Workshop on Infectious Disease: Sept 28-29, 2006

Frontier in Biophysics: Modelling and Experiment:

Oct. 13-15, 2006: A cross-institute retreat including members of the UBC math Biology group, the UBC Biophysics groups and the SFU Biophysics groups among others at PIMS institutes.

PIMS VISITORS:

Arpita Upadhyaya (University of Maryland), April 26, 2006; April 28, 2006

Alex Mogilner (University of California, Davis), September 13, 2006

Richard Bertram (Florida State University) September 20, 2006

GEOMETRIC AND HARMONIC ANALYSIS

2006-2008

Geometric functional analysis is concerned with geometric and linear properties and structure of finite- and infinite-dimensional Banach spaces and their unit balls. An asymptotic point of view is based upon expressing such properties in terms of various quantitative invariants whose limiting behavior is investigated when the dimension or a number of other relevant free parameters tends to infinity. For example, the main probabilistic tools used in the theory are deviation inequalities and the concept of concentration of measure phenomenon, that is in fact an isomorphic form of isoperimetric type inequalities. These and other deep geometric, probabilistic and combinatorial methods developed here are widely used outside the field, in discrete geometry, classical convexity, asymptotic combinatorics and computer science, among others. For example, one area where new applications has been very recently developed is the signal reconstruction and encoding, that is intimately related to the quantitative study of singular numbers of random matrices, including random ± 1 matrices and to the study of random sections of convex bodies. More generally, an underlying principle lies in identifying and exploiting “approximate” (or “isomorphic”) symmetries of various problems, thus allowing to detect regularities which could not be tackled by more rigid methods. For example, this approach and related techniques (originating in the local theory of Banach spaces in 1970’s) have been recently successfully used as a starting point in problems on amenability of certain natural Banach algebras which is on the border of abstract harmonic analysis and Banach algebra theory. The groups of asymptotic geometric analysis and discrete geometry in Western Canada (and some researchers in Toronto) have very close ties with the newly established European Network in Phenomena in High Dimensions (PHD) and we presently investigate whether it is possible to formalize these ties in some way. Asymptotic geometric analysis held a number of meetings every year, in PIMS it held two successful summer programs in Vancouver: 3 weeks program in 1999 and 2 months Thematic Summer Programme in 2002.

Abstract harmonic analysis relates to the studies of Banach algebras of spaces of measures or functions associated to (unitary representations of) a locally compact group involving powerful tools from group representations, geometry of Banach space, operator algebras and operator space theory. Two locally compact groups are isomorphic if and only if certain associated Banach algebras (i.e., Fourier algebras or the group algebra) are isometrically isomorphic. Consequently, the study of various Banach algebras and their geometric properties reveals deep structural properties of the underlying group. For example the classical result of B. E. Johnson asserts that the group algebra is amenable if and only if the underlying group is amenable. An analogous result for the Fourier algebra has been proved only very recently by Z. J. Ruan and it involves so-called operator amenability by viewing the Fourier algebra as an operator space. A characterization of amenability in terms of a deep combinatorial property of Følner led to a strong relationship to the recent study of amenable unitary representations of locally compact groups, geometry of Fourier and Fourier-Stieltjes algebra of a group as well as Hahn-Banach type separation and extension properties for closed subgroups of a locally compact group by positive definite functions by experts in Canada and around the world including Kaniuth and Lau.

CRG LEADERS:

Karoly Bezdek (UofC), Michael Lamouroux (UofC), Anthony to-Ming Lau (UofA),
Nicole Tomczak Jaegermann (UofA)

POST-DOCTORAL FELLOW: Hung Le Pham

SCIENTIFIC ACTIVITIES:

Distinguished Chair Lecture: Thomas Hales (University of Pittsburgh), Oct. 2, 2006 - UofC

Distinguished Chair Lecture: Apostolos Giannopoulos (University of Athens), Nov. 12-19, 2006 - UofC

Distinguished Chair Lecture: Henry Cohn (Microsoft Research), Nov. 29-30, 2006 - UofC

Hermann Koenig (Kiel University), Sept. 4-29, 2006 - UofA

Eberhard Kaniuth (Institut für Mathematik der Universität Paderborn), March 14-15, 2007 - UofA

Operator Spaces and Groups Algebras Workshop, August 19-24, 2007 BIRS

Conferences

For details of lecturers and seminars, please go to <http://www.pims.math.ca/scientific/scientific-lecture>

Pacific Northwest Geometry Seminar

University of British Columbia

April 1-3, 2006

Speakers: Alejandro Adem (University of British Columbia), Jim Bryan (University of British Columbia), Yong-Geun Oh (University of Wisconsin-Madison), Ben Chow (UC San Diego), Simon Brendle (Stanford University) Gang Tian (Princeton University)

Titles: A Stringy Product for Twisted Orbifold K-theory, Global convergence of the Yamabe Flow, Donaldson-Thomas and Gromov-Witten Invariants of Orbifolds and their Crepant Resolutions, On the works of D. Glickenstein and F. Luo on Semi-Discrete Curvature Flows, Lagrangian currents, Calabi Invariants and non-simpleness of the area-preserving Homeomorphism group of S^2 , Kahler-Ricci flow and complex Monge-Ampere equation

ABC Algebra Workshop

University of British Columbia

April 8-10, 2006

Speakers: Skip Garibaldi, Vladimir Chernousov, Patrick Brosnan, Alfred Weiss, Jan Minac, Alejandro Adem

Titles: Cohomological invariants, Connectedness of classes of fields and zero cycles on projective homogeneous varieties, Motives of Feynman diagrams, Galois invariants and p-adic L-functions, Galois groups of maximal p-extensions and Galois modules, Commuting Elements and Spaces of Homomorphisms

Changing the Culture 2006:

April 21-22, 2006

Speakers: Bernice Kastner (Prof. Emerita, Towson University, SFU), Peter Liljedahl (SFU), Melania Alvarez Adem (PIMS), Kieran Egan (SFU), Rose Albiston (Terry Fox Secondary), Pamela Hagen (Westwood Elementary/UBC), Jonathan Jedwab (SFU), Shabnam Kavousian (Langara/SFU), University of British Columbia

Titles: Let's Confuse Them With the Facts!, Numeracy Tasks: Putting Mathematical Understanding to the Test, Numeracy at Post-Secondary Level, Engaging Students' Imaginations in Mathematics, Obstacles To Understanding, SFU

Fifth International Conference on Scientific Computing & Applications

University of Alberta

May 18-22, 2006

This conference was the fifth of a sequence of conferences on Scientific Computing and Applications to be held in the Pacific Rim region. Their goal is to bring together mathematicians, scientists and engineers working in the field of scientific computing and its applications to solve scientific and industrially oriented problems and to provide a forum

for the participants to meet and exchange ideas of common interest in an informal atmosphere. The focus of this particular conference was on the problems and methods related to image processing, financial applications and modelling of multiphase flows.

Canadian Operator Symposium 2006

University of Calgary

May 29 - June 3, 2006

Speakers: Bill Arveson (University of California at Berkeley), Ken Davidson (University of Waterloo), Chandler Davis (University of Toronto), Ron Douglas (Texas A&M), George Elliott (University of Toronto), Don Hadwin (University of New Hampshire), Huaxin Lin (University of Oregon), Vern Paulsen (University of Houston), Chris Phillips (University of Oregon)

The 34th Annual Canadian Operator Symposium (COSy) took place at the University of Calgary from May 29 - June 3, 2006. The symposium was also to celebrate the 65th birthday of Peter Rosenthal, UoT. There were a number of short talks throughout the symposium beginning at 9am on May 29th.

Organizers: Berndt Brenken, Michael Lamoureux

Motives and Periods

University of British Columbia

June 5 - 13, 2006

The conference was intended to cover developments in the study of motives and periods with an emphasis to the connections to physics, arithmetic and algebraic cycles. The conference has an instructional component and provided an opportunity for young speakers to present their results. Organizers paid special attention to the support of women for this conference, at the senior level as well as at the level of postdocs and graduate students.

2006 Summer School on Mathematical Modeling of Infectious Diseases

York University

June 10-20, 2006

The objective of this summer school was to provide effective training for collaborative research in infectious diseases based on mathematical modeling and qualitative analysis.

Organizers: Fred Brauer (UBC), Kamran Khan (Toronto/St. Michael Hospital), Babak Pourbahloul, (BC CDC), Pauline van den Driessche (Victoria), Lin Wang (Victoria, Program Assistant), James Watmough (New Brunswick), Jianhong Wu (York, Chair), and Huaiping Zhu (York)

Western Canada Linear Algebra Meeting (WCLAM)

University of Victoria
June 23-25, 2006

Speakers: Richard Brualdi, UWF Beckwith Bascom Professor of Mathematics, Department of Mathematics, University of Wisconsin, Anne Greenbaum, Professor, Department of Mathematics, University of Washington, Mark Lewis, Canada Research Chair in Mathematical Biology, Department of Mathematical and Statistical Sciences, University of Alberta
This was the 7th in a series of meetings that have been held since 1993. WCLAM provides opportunities for mathematicians and other researchers in western Canada working in linear algebra and related fields to meet and discuss their research. The meeting was also held in honor of Pauline van den Driessche on the occasion of her 65th birthday.

Canadian Number Theory Association IX Conference

University of British Columbia
July 9-14, 2006

Over 200 participants attended this conference, 156 of those came from outside Canada. Speakers brought a wide range of number theory research topics. The six-day conference featured 12 plenary speakers with lectures from various areas in number theory research. Some of the plenary speakers were: Frits Beukers (Utrecht), Brian Conrad (Michigan), Carl Pomerance (Dartmouth), Michel Waldschmidt (Jussieu)

There were sessions on number theory such as *Algebraic Number Theory*, *Analytic Number Theory*, *Arithmetic Algebraic Geometry*, *Computational Number Theory*, and *Diophantine Analysis and Approximation*.

The conference was sponsored by PIMS, UBC, and SFU, as well as the Number Theory Foundation. Further information on the conference can be found at <http://www.pims.math.ca/science/2006/06cnta/>.

2006 IEEE International Symposium on Information Theory

The Westin Seattle
July 9-14, 2006
<http://www.isit2006.org/>

Summer School on Frontiers in Mathematics and Economics

University of British Columbia
July 10-21, 2006

The summer school brought together graduate students, postdoctoral fellows and young faculty members from business school, economics, mathematics and operations research with leading economists and mathematicians. It exposed students in business administration and economics to mathematical models and methods that they might find useful in their research. The main focus of the summer school was a set of four courses:

“Dynamic Contract Theory and Corporate Finance”

Jean-Charles Rochet (Professor of Mathematics and Economics, U. Toulouse I)

“Equilibrium: Theory and Computation”

Kenneth L. Judd (Senior Fellow, Hoover Institution on War, Revolution

and Peace), R. Tyrrell Rockafellar, (Professor of Mathematics, U.

Washington), Roger Wets (Professor of Mathematics, UC, Davis)

“Information and Markets”

William R. Zame (Professor of Mathematics and Economics, UC, Los Angeles)

“The mathematical Structure of Quality Pricing”

Ivar Ekeland (Professor of Mathematics and Economics, UBC)

Sequences & Codes

Simon Fraser University
July 21-22, 2006

The conference explored new research direction within the fields of sequence design and algebraic error-correcting codes, including radar applications of sequence design, algebraic constructions of space-time codes, and pseudocodewords. The aim was to bring together mathematicians and engineers, and to increase the pool of early career researchers who appreciate the power of discrete mathematics and the important role that it plays in emerging engineering disciplines.

International Conference on Stochastic Analysis and its Applications

University of Washington
August 7-11, 2006

The main topics of the conference were Stochastic analysis and its applications, Markov processes, Dirichlet forms, Analysis on fractals and percolation clusters. One of the goals of this conference was to expose young researchers and PhD students to the most recent developments in the active areas of probability theory.

EQUIPS 2006

The Sixth Canadian Summer School on Quantum Information Processing

University of Calgary
August 7-11, 2006

The goal of the summer school was to introduce quantum information processing to a general audience of participants in the areas of mathematics, computer science and physics. The objective was to provide individuals with little or no background in quantum information processing with the knowledge to understand the principles of quantum mechanics and how they can be used for computations and in communication. It is an interdisciplinary area that brought together theorists and experimentalists.

Sixth Canadian Summer School in Quantum Information Processing

University of Calgary
August 7 - 12, 2006

The objective of the summer school was to present mathematical and geophysical foundation material to appreciate the subsequent GIW. The main focus of the SISS was seismic imaging and related inverse scattering theory. The lecturers were appropriate for graduate students in mathematics, geophysics, or related fields. The goal was to introduce a general audience of computer scientists, physicists, and mathematicians with little or no background in quantum information to this exciting field.

Sponsors: Pacific Institute for the Mathematical Sciences MITACS Canadian Society of Exploration Geophysicists Consortium for Research in Elastic Wave Exploration Seismology, University of Calgary, Petro-Canada Progress Nexen ProEx Energy, ConocoPhillips EnCana POTSI

Summer School on Strings, Gravity & Cosmology

University of Alberta
August 7 - 19, 2006

This was the 4th in a sequence of annual summer schools in theoretical physics held in Canada. The schools are intended to educate graduate students and young researchers on current developments in string theory and its interface with gravity and cosmology.

Organizers

Andreas Karch (University of Washington), Taejin Lee (Kangwon National University & APCTP), Robert Myers (Perimeter Institute and University of Waterloo) Moshe Rozali (University of British Columbia) Gordon Semenoff (University of British Columbia) Mark Van Raamsdonk (University of British Columbia)

CECM Summer Meeting 2006

Simon Fraser University
August 9, 2006

This one day mini workshop focussed on computational mathematics. The workshop program included talks and a poster session which covered a variety of topics in mathematics with an emphasis on computation.

18th Canadian Conference on Computational Geometry

Queen's University
August 14-16, 2006

CCCG focussed on the mathematics of discrete geometry from a computational point of view. Abstracting and studying the geometry problems that underlie important applications of computing leads not only to new mathematical results, but also to improvements in their application areas.

Geophysical Inversion Workshop

University of Calgary
August 14-18, 2006

The second PIMS GIW was held on the University of Calgary Campus in August of 2006. The purpose of the workshop was to bring together mathematicians and geophysicists to focus on a challenging inversion theme. The theme of this meeting was 'seismic imaging and wave propagation'.

Sponsors: PIMS, MITACS, Canadian Society of Exploration Geophysicists, Consortium for Research in Elastic Wave Exploration Seismology, University of Calgary, Petro-Canada, Progress, Nexen, ProEx Energy, ConocoPhillips, EnCana, POTSI

Canadian Quantum Information Student's Conference

University of Calgary
August 14-19, 2006

CQISC provided the ideal environment for graduate students interested in all areas of Quantum Information Theory and Experiment to meet and collaborate. Delegates presented 30 minutes talks on their area of research. Some topics included: topological quantum computing, pseudo-telepathy and quantum game theory and more.

Stability and Instability of nonlinear Waves

University of Washington
September 6-9, 2006

The goal of the workshop was to provide an overview of current state-of-the-art methods for examining stability, as well as to present some widely applicable new techniques. The format consisted of four invited speakers which gave lectures at a level aimed mostly at graduate students but useful for all those involved in other disciplines such as engineering, biology, etc.

Frontiers in Biophysics: Modelling and Experiment

University of British Columbia
October 12-16, 2006

This weekend retreat was organized by graduate students and faculty in biophysics and mathematical biology at SFU and UBC. The event was meant to bring together both biophysics and modelling in molecular and cell biology research in the Vancouver area.

Joint UBC/SFU Seminar in Statistics

British Columbia Cancer Research Centre
November 10, 2006

The fourth joint UBC/SFU Seminar in Statistics attracted approximately 60 participants, including faculty, staff and graduate students, as well as numerous researchers from the local medical centre. Two talks concentrated on statistics issues arising from medical and health related research. A lively discussion followed each talk making the seminar a success. The next seminar will be held in winter of 2007.

The 4th SFU/UBC Statistics and Actuarial Science Graduate Student Workshop

Simon Fraser University
November 18, 2006

The graduate caucus in the department of Stats and Actuarial Science in SFU held a workshop in the Interdisciplinary Research in the Mathematical and Computer Sciences Centre, Burnaby Campus. Various talks covered important parts of graduate studies, mainly focusing on teaching and consulting.

Geometry, Topology and their Interactions An International Conference in Honor of Farrell-Jones

Morelia, Mexico
January 8-13, 2007

This conference gathered together mathematicians whose work lies at the interface of geometry and topology. There were three series of introductory lectures on high dimensional topology, controlled topology and geometri group theory for topologists.

2nd International Conference on Algorithmic Operations Research (AlgOR 2007)

Simon Fraser University
January 21-23, 2007

The conference brought together researchers, practitioners, and graduate students interested in design and analysis of algorithms for operations research models and its applications.

Eighth Coast Combinatorics Conference

University of Victoria
February 24-25, 2007

Speakers: Rick Brewster (Thompson Rivers University); Stephen Finbow (StFX); Gary MacGillivray (UVic), Laura Yang (UofA), Aaron Williams (UVic), Luis Goddyn (SFU), Wendy Myrvold (UVic), Tom Brown (SFU), Gara Pruesse (Malaspina), Moshe Rosenfeld (U. Washington), Mohammad Ghebleh (SFU), Joe Peters (SFU), Frank Ruskey (UVic), Art Finbow (St. Mary's), Petr Lisonek (SFU), Mark Weston (UVic), Brett Stevens (Carleton).

The conference consisted of a sequence of talks 30-45 minutes in length on topics such as fractional maximal, symmetries of venn diagrams and many more.

Workshop on Rock Mechanics and Logistics in Mining

Santiago de Chile
February 26-March 2, 2007

As a result of a meeting organized by the CMM and PIMS at BIRS in November 2005, all centres agreed to promote the organization of this workshop.

Complex Geophysical Gravity Current

University of BC
March 2 - 4, 2007

Organized by the CRG on Complex Geophysical Fluid Dynamics.

The aim of the workshop was to bring together experts in granular media, non-Newtonian fluids dynamics and plasticity theory with researchers actively studying geological hazards.

PIMS Graduate Students Workshop

University of Alberta
March 3-4, 2007

Various topics were presented by PIMS graduate students in areas of generalized function spaces in Banach Algebras, Pseudodifferential Operator Theory, Euclidean d-space and many more.

Third Northwest Functional Analysis Symposium

Banff, Alberta BIRS
March 30-April 1, 2007

Organizers:

Berndt Brenken (University of Calgary), Juliana Erlijman (University of Regina), Alexander Litvak (University of Alberta), John Phillips (University of Victoria).

These 2-d meetings bring together researchers in functional analysis from universities in Western Canada and provide a platform to have eight forty-minute talks, with plenty of time for informal discussion. Emphasis was on young faculty, post-doctoral fellows, visitors to the area and any particularly "hot" topic.

PIMS Postdoctoral Fellows for 2006/07

PIMS HAS CREATED A LARGE NUMBER OF POSTDOCTORAL OPPORTUNITIES FOR YOUNG RESEARCHERS IN THE MATHEMATICAL SCIENCES. THE REGULAR PIMS PDF COMPETITION TAKES PLACE EACH JANUARY. PDFS ASSOCIATED WITH THE COLLABORATIVE RESEARCH GROUP PERIODS OF CONCENTRATION GO THROUGH THE SAME RIGOROUS REVIEW PROCESS. CANDIDATES MUST BE NOMINATED BY A SCIENTIST OR GROUP OF SCIENTISTS AFFILIATED WITH PIMS. FELLOWSHIPS ARE TENABLE AT ANY OF THE CANADIAN MEMBER OR AFFILIATED UNIVERSITIES.

SIMON FRASER UNIVERSITY

Joashua Buresh-Oppenheim:
Computational Complexity
Supervised by David Mitchell

Yongmei Liu: *Artificial Intelligence*
Supervised by Eugenia Ternovska

Robert Samal: *Graph Theory*
Supervised by Bojan Mohar and Pavol Hell

Rahul Santhanam: *Computational Complexity*
Supervised by Valentine Kabanets

Ronald van Luijk: *Number Theory*
Supervised by Nils Bruin

UNIVERSITY OF ALBERTA

Mohammad Akbar: *General Relativity*
Supervised by Eric Woolgar

Dana Cobzas: *Algebraic Geometry*
Supervised by Martin Jagersand and John Bowman

Holly Freedman: *Biophysics*
Supervised by Jack Tuszynski

Hung Le Pham: *Harmonic and Geometric Analysis*
Supervised by Tony Lau

Iulia Pop: *Algebraic Geometry*
Supervised by Arutro Pianzola

Andriy Prymak: *Approximation Theory*
Supervised by Zeev Ditzian

Suang Cai: *Algebraic Geometry - CRG*
Vladimir Chernousov

UNIVERSITY OF BRITISH COLUMBIA

Nathaneal Berestycki: *Probability*
Supervised by Alexander Holroyd

Alexi Cheviakov: *Partial Differential Equations*
Supervised by George Bluman

Gert Williams: *Robust Statistics*
Supervised by Ruben Zamar and Matias Salibian-Barrera

UNIVERSITY OF CALGARY

Lassina Dembele: *Number Theory*
Supervised by Clifton Cunningham

Ali Reza khani: *Quantum Information Science*
Supervised by Barry Sanders

Niu Zhuang: *Algebra*
Supervised by Berndt Brenken

UNIVERSITY OF VICTORIA

Lin Wang: *Mathematical Biology*
Supervised by Pauline van den Driessche and Fred Brauer

Xiaoming Yuan: *Statistics*
Supervised by Jane Yu

UNIVERSITY OF WASHINGTON

Aravind Asok: *Algebraic Geometry*
Supervised by Charles Doran

Xiaosheng Li: *Inverse Problems*
Supervised by Gunther Uhlmann

UNIVERSITY OF REGINA

Pedro Massey: *Operator Algebras and Operator*
Supervised by Martin Argermai

UNIVERSITY OF LETHBRIDGE

Pablo Spiga: *Finite Group Theory*
Supervised by Joy Morris

PIMS Industrial Activities

PIMS views mathematics as a chain, connecting core mathematics to applied and industrial mathematics. PIMS works to ensure that the chain is strengthened through continued collaboration and research between mathematicians and industry. Since 1997, PIMS has organized annual Graduate Industrial Mathematics Modelling Camps (GIMMC), followed by Industrial Problem Solving Workshops (IPSW). These programmes provides the necessary opportunities and infrastructure for intensive study periods in which graduate students are exposed to challenging industrial problems with a mathematical content. Research workers with industrial and commercial concerns are invited to present one of their current technical problems. Students who have gone through the GIMMC study these problems in teams during the IPSW. They are mentored by faculty throughout, and present the results of their study to the industrial participants at the end of the week. Problems come from a wide variety of subject areas related to applied and industrial mathematics, with an emphasis on mathematical modelling and analysis.

PIMS industrial activities are by no means limited to the GIMMC and IPSW. PIMS Collaborative Research Groups also have important industrial components. For example, the CRG on Inverse Problems, led by Gunther Uhlmann (U. Washington) and Gary Margrave (U. Calgary), is organizing a major international summer school on Seismic Imaging and a workshop on Geophysical Inversion in the summer of 2006. Such conferences are fundamentally connected to problems in oil exploration.

Since 2005, PIMS has systematically built contacts with the mining industry in B.C. and the oil industry in Alberta. PIMS has also expanded its scientific activities to include focused research projects in industrial mathematics, which combine cutting-edge mathematics with strategic industrial problems. In particular, PIMS developing an exciting project on the Mathematics of Mining in collaboration with its partners at the Centro de Modelamiento Matemático in Chile. PIMS will be co-organizing an important international meeting on this topic in Santiago in February, 2007. An international project on the mathematics of oil exploration is being developed, connecting scientists in Alberta with PIMS's partners in Mexico.

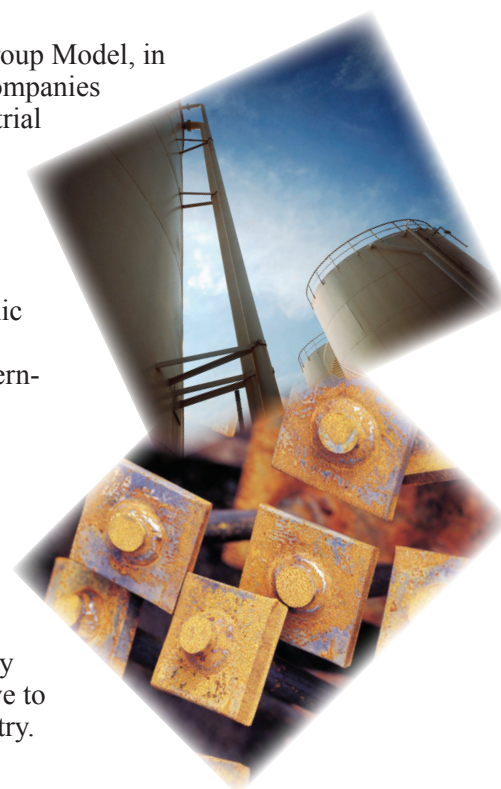
INDUSTRIAL PROGRAMME COMPONENTS

Industrial Problem Solving Workshops are based on the Oxford Study Group Model, in which problems of relevant and current interest to participating industrial companies are posed to the workshop participants, by experts from those various industrial companies. Participating graduate students and faculty spend five days working on the problems, and the results are published. The advantages for participating students and academics are:

- The challenge of applying one's skills to new and relevant problems directly applicable to industry.
- The opportunity for continued collaboration with the workshop's academic and industrial participants.
- Helping PIMS and mathematics by demonstrating to businesses and governments the tangible benefits of supporting the mathematical sciences.

PIMS Graduate Industrial Mathematics Modeling Camps have graduate students from Canadian universities attend to learn various aspects of high-level techniques for solving industrial mathematics problems. The camp prepares them for the PIMS Industrial Problem Solving Workshop (IPSW), which follows the GIMMC.

Industrial workshops, mini-courses and summer schools are organized by PIMS researchers, with topics of interest to both industry and academia serve to disseminate newly developed mathematical tools that can be of use in industry.



Industrial Problem Solving Workshop

9TH ANNUAL PIMS GRADUATE INDUSTRIAL MATHEMATICS MODELLING CAMP (GIMMC)

Simon Fraser University

June 21-25, 2006

The 9th PIMS Annual Graduate Industrial Mathematics Modelling Camp was held at SFU from June 21-24, 2006. Six countries were represented with a total of 147 people, resulting in 42 participants. GIMMC prepares students for the Industrial Problem Solving Workshop (IPSW) by giving them the opportunity to meet and work with other participants, working in a group setting and learn new modelling techniques. The mentors allowed the students to develop their own ideas and directions, while under the watchful eye of the mentors. The students were divided into groups on six different problems under the mentorship of a diverse group of professionals:

Jose Adachi (Schlumberger Oilfield Services, Sugarland, Texas): Mr. Adachi presented a real problem related to a recent accident on an offshore oil rig operated by one of Schlumberger's partners. When drilling the company needed to pump mud from several kilometres underground through the wellbore to cool the drilling and data collection tools located at the end of the shaft. The GIMMC team had to develop a model to understand how high the temperatures would rise if the flow of mud stopped and how the temperature at the tool site depends on the flow rate of mud coolant.

Derek Bingham (Simon Fraser University): Dr. Bingham brought a problem on a experiment design to the GIMMC. How can we best explore a parameter space when data collection is very expensive? The team worked on a model problem scenario involving wait times for a web server. A business was interested in how long customers needed to wait under different demand conditions.

Poul Hjorth (Technical University of Denmark) Dr. Hjorth brought a problem on bell ringing. The problem was if we have n bells in a tower and we wanted a bell at a fixed interval, how can we pull on the bells to change the order in which they ring? The group developed both analytical and numerical solutions as to when, and how hard, each rings should ring each bell in order to perform a given sequence.

Keith Promislow (Michigan State University) Dr. Promislow is an industrial mathematician who has worked for many years with Ballard Power in Vancouver. His problem was on modeling the build-up of carbon dioxide in running fuel cells. The group built a simple model of the dynamics within a fuel cell and explored simple ways to alleviate the build-up of carbon-dioxide.

Randall Pyke (SFU) Based on an IPSW problem involving the numerical simulation of forest fires, Dr. Pyke presented a problem using an alternate approach for modeling such phenomena. The students worked to develop a discrete cellular automaton model of the spread of forest fires to understand both the strengths and weaknesses of such an approach.

Juan Restrepo (University of Arizona) Dr. Restrepo presented the students with several different approaches to overcoming these problems and had them work through one in particular. Many physical models have undetermined coefficients and need to be compared to noisy physical data.

At the end of the meeting, each group was to present their findings. The results are available on the PIMS website. Both students and mentors found this to be a valuable experience and they would come again. Conference organizer, J.F. Williams (SFU) believes that this was the strongest group of students that PIMS has ever had at the GIMMC. Next year's GIMMC will be in Edmonton, Alberta on June 5-9, 2007.

10TH PIMS INDUSTRIAL PROBLEM SOLVING WORKSHOP SIMON FRASER UNIVERSITY, JUNE 26, -30, 2006

The 10th PIMS Industrial Problem Solving Workshop assembled a group of 65 academics from across Canada, the United States, the United Kingdom, Denmark, Mexico, Singapore, Austria and Australia to work on seven problems submitted by both public and private industry. The workshop was held at Simon Fraser University from June 26-30, 2006 and organized by J.F. Williams (SFU).

Seven problems were presented on June 26 and participants were to complete the problems and present their findings after one week. Those problems were:

Applied Innovations: *Scheduling Road Maintenance Procedures*

Aurel System: *Numerical solution of multicomponent vapour-liquid calculations*

B.C. Centre for Disease Control: *Determining the impact of a new testing procedure on the spread of HIV.*

B.C. Ministry for Advanced Education: *How can we predict future student demand at post-secondary institutions?*

B.C. Ministry of Finance: *Modelling Future Electricity Prices*

Prometheus (the Canadian Forest Fire Model): *Improving the Numerical Simulation of Forest Fires.*

Schlumberger Oilfield Services: *Modelling the Release of an Encapsulated Breaker*

This year's IPSW was very successful and considered the largest study group that PIMS has organized. The next IPSW will be held in Edmonton, Alberta on June 11-15, 2007.

FIELDS-MITACS-PIMS SUMMER SCHOOL ON MATHEMATICAL MODELLING OF INFECTIOUS DISEASES, YORK UNIVERSITY, TORONTO, JUNE 10-20, 2006

The summer school on Mathematical Modelling of Infectious Disease highlighted the modelling process and the interaction between epidemiology and mathematics, to provide language and framework for the students to think and formulate infectious disease problems mathematically. This process demonstrated modelling approaches for public health issues.

A series of public lectures covered a wide range of topics on issues and diseases relating to public health. Topics included:

- How Mathematical Modelling Contributes to Infectious Diseases Control?
- Modelling Pandemic Influenza
- The Challenges & Opportunities in Modelling Wildlife Diseases
- Mathematical Epidemiological Approaches Towards public security
- The Integration of epidemic models into cost-effectiveness analysis of Universal Hepatitis A Vaccination in Canada
- Modelling HIV in India
- How commercial Air Traffic is a global conduit for emerging infectious diseases
- Mathematical modelling contributed to the study of the West Nile Virus

SEQUENCES AND CODES CONFERENCE, SIMON FRASER UNIVERSITY, JULY 17-21, 2006

The conference was an interdisciplinary meeting that brought together mathematicians, electrical and computer engineers, and informatics and computer scientists. Seventy participants from Canada, US and overseas universities, represented the diverse range of the new research area of sequences and codes. Participants studied new research directions within the field of sequence design and algebraic error-correcting codes, including radar applications of sequence design, algebraic constructions of space-time codes, and pseudocodewords.

The conference was sponsored by PIMS and co-sponsored by MITACS, NSF, and PRIMA. Conference organizers were Nigel Boston (University of Wisconsin, Madison), Robert Calderbank (Princeton University) and Jonathan Jedwab (Simon Fraser University).

INTERNATIONAL CONFERENCE ON STOCHASTIC ANALYSIS AND ITS APPLICATIONS, UNIVERSITY OF WASHINGTON, AUGUST 7-11, 2006.

The International Conference on Stochastic Analysis and Its Application was held at the University of Washington on August 7-11, 2006. Topics covered a wide area of stochastic analysis, including Markov processes, jump type processes, measure-valued processes, Dirichlet forms and multiparameter processes such as Brownian sheets. The main goal of the conference was to bring together researchers from all over the world to study the changes in this field, exchange ideas and create future collaborations.

Thursday afternoon's schedule was devoted to celebrate Professor Masatoshi Fukushima's 70th birthday. Dr. Fukushima visited the University of Washington as the PIMS Distinguished speaker from July 17-27, 2006.

The conference was organized by Krzysztof Burdzy and Zhen-Qing Chen, and financed from several sources, including NSA, University of Washington, and co-sponsored by PIMS.

SEISMIC IMAGING SUMMER SCHOOL AND GEOPHYSICAL INVERSION WORKSHOP, UNIVERSITY OF CALGARY, AUGUST 7-18, 2006.

The conference brought together mathematicians and geophysicists to discuss developments in the field of seismic imaging and wave propagation.

The conference were co-sponsored by PIMS, the Canadian Society of Exploration Geophysicists (CSEG), the Consortium for Research in Elastic Wave Exploration Seismology (CREWES) and MITACS. It was organized by Gary Margrave (UofC), Gunther Uhlmann (UofWashington), Maurivio Sacchi (UofC), Peter Cary (CSEG), and Robert Stewart (CREWES).

The summer school focused on seismic imaging and related inverse scattering theory. Over 50 students attended the course, including graduate students from mathematics, geophysicists, practicing scientists and mathematicians in the oil industry, and academic scientists.

Lectures included the fundamental mathematics of the wave equation including boundary and initial conditions, well posedness, fundamental solutions, and Huygen's principle. Three lectures focused on the mathematics and physics of the Kirchhoff seismic imaging algorithm. And one lecture on the mathematical basis for the linear sampling method, inverse scattering technique widely used in electromagnetics.

The workshop covered topics in the dual themes of seismic imaging and wave propagation. The conference centered on lectures from various invited speakers: Norm Bleistein (Colorado School of Mines), Chris Chapman (Schlumberger Cambridge Research), David Colton (University of Delaware, Maarten de Hoop (Purdue University), Lou Fishman (Slidell/MDF International) to name but a few.

EDUCATIONAL ACTIVITIES

<http://www.pims.math.ca/education>

PIMS sponsors and coordinates a wide assortment of educational activities targeting K-12 students and teachers, as well as undergraduate and graduate students, women, and minorities. Many of PIMS' best research scientists are involved in these activities. Since its inception, PIMS has actively been involved in promoting mathematical outreach in the schools of Alberta and British Columbia. They involve students, teachers and parents, and seek to convey the excitement of discovery learning that underlies mathematics and its applications. The following is a list of some of the major outreach activities that are currently organized by PIMS.

PIMS is responsible for organizing events throughout British Columbia to help develop a better awareness of mathematics, through the countless hours of volunteer efforts of mathematicians, in order to create an atmosphere where teachers and students enjoy learning math.

First Nations Education Programs and Outreach

Educators and mathematicians alike met at the Banff Center, in Banff, Alberta on June 2006. This conference was to bring together mathematicians and educators interested in working with First Nations communities to develop mathematical programs that would provide opportunities to First Nations students better access to math and science education. Participants focused on the challenges faced by First Nations children in the educational system. Researchers were encouraged to present their experiences or describe ongoing research on these issues. The objective was to develop a document that outlines these issues to be used as a framework to addressing the major challenges in these aspects of education of First Nations students. Teacher training in mathematics was held at the Sk'elep school of Excellence at Kamloops, Stein Valley Nlaklapamux at Lytton, and Neqweyqwelsten School at Barriere. These schools also participated in student assessment and placement. A successful mentorship program with students from Thompson Rivers University assisted teachers at Sk'elep school of Excellence at Kamloops

Educational Activities

3rd Annual Young Researchers Conference for Mathematical and Statistical Sciences
University of Alberta
April 1-3, 2006

Annual Changing the Culture Conference at PIMS-SFU
SFU Harbour Center
April 21, 2006

8th Annual ELMACON 2006
(Elementary Grades Math Contest)
PIMS-UBC, April 29, 2006

4th Annual Contest for Epsilons
University of Victoria
May 1, 2006

The Alberta College Mathematics Conference:
North-South Dialogue
Mount Royal College
May 4, 2006

FAME (Forever Annual Mathematics Exhibition) 2006
University of Victoria
May 9, 2006

PIMS Education Awards Day
University of Alberta
June 6, 2006

9th PIMS Graduate Industrial Mathematics Modelling
Camp, SFU
June 21-25, 2006

PIMS Mathematical Summer Camps
PIMS-UBC
Math and Art: August 21-25, 2006
Math and Nature: August 28 - Sept. 1, 2006

4th SFU-UBC Statistics and Actuarial Science Graduate
Student Workshop
Simon Fraser University
November 18, 2006

PUBLICATIONS

PIMS NEWSLETTER 10.1



PIMS Magazine Vol. 10 Fall 2006

Alberta Government contributes \$1.147-million to PIMS for 2006-2009

The Pacific Institute for the Mathematical Sciences (PIMS) has received a renewal of support from the Alberta Innovation and Science (AIS) for PIMS' mathematical activities in Alberta. PIMS will receive \$1.147 million over three years from the Alberta government agency.

AIS funded an PIMS' established research and education in Western Canada as the means to renew and increase funding to \$1.147 million between 2006 and 2009. With the initial AIS funding in 2004, PIMS developed activities towards mathematical education and research in Alberta, demonstrating PIMS' dedication to developing leaders in programs for Alberta's mathematical community. With the new funding, PIMS plans to increase its commitment to education and research in Alberta, and will participate in the AIS' three major research priorities: life sciences, energy research, and information and communication technologies.



Interview with Ingrid Daubechies



The Princeton professor speaks with PIMS about mathematics, research in industry, and being a woman in a male-dominated field. Interview on Page 15

Institutional Autonomy Consecrates BIRS's Role as World Resource

The Banff International Research Station (BIRS) was held in September, 2005, and inaugurated in March, 2005 — was the fulfillment of a remarkable international effort led by PIMS on the Canadian side and by BIRS (Banff, CA) on the American side, along with the help and participation of the MITACS network. Encouraged by BIRS' successful five-year funding renewal by the AIS (Alberta), the NSF (USA), NSERC (Canada) and CONACYT (Mexico), the BIRS Steering Institution announces that the research station has reached the stage when it is ready to increase full scientific and administrative autonomy.

With a 30-member International Advisory Group, drawn from international and all over some of the Mathematical Sciences, BIRS now fully administers the research programme. The Program Committee steers scientific excellence and manages administrative affairs of each of the sciences, as well as an appropriate geographic balance among disciplines. The Executive Committee, consisting of the directors of BIRS, PIMS, BIRS, MITACS and the ICMAS, now steers a separate body dealing solely with its own pertaining to management. The Scientific Director of BIRS is the famous Professor...

with and the AIS. The requirement to have a Canadian and American organizer for each five-day meeting has been removed, and the competition is now open to all.

The new organizational structure of BIRS serves a program and further government structure that will enable BIRS to attract the best proposals from all over the world. PIMS, NSERC and MITACS congratulate BIRS on its renewal and on the new era of scientific excellence open which it is about to embark. BIRS will continue its tradition to manage the education and research transactions between community from all of the mathematical, computational and statistical sciences.

PIMS Launches Partnerships with Latin America

The Institute for the Mathematical Sciences (PIMS) and the Centro de Matemáticas de Montevideo (CMM) have signed a cooperation agreement. CMM, based at the University of Chile in Santiago, is the leading center in Latin America for applied and industrial mathematics.

PIMS has also signed an agreement with Instituto de Matemáticas (IUMA) in Mexico, for cooperation on industrial research. For more on PIMS and CMM, please see pages 4-5. For more on PIMS and IUMA, please see page 7.

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PI IN THE SKY

All issues of *Pi in the Sky* can be downloaded for free from the Pi in the Sky web page. Significant funding for *Pi in the Sky* is provided by Alberta Innovation and Science.

Pi in the Sky is primarily aimed at high-school students and teachers, with the main goal of providing a cultural context/landscape for mathematics. It has a natural extension to junior high school students and undergraduates, and articles may also put curriculum topics in a different perspective.

Pi in the Sky accepts materials on any subject related to mathematics or its applications, including articles, problems, cartoons, statements, jokes, etc. Copyright of material submitted to the publisher and accepted for publication remains with the author, with the understanding that the publisher may reproduce it without royalty in print, electronic, and other forms. Submissions are subject to editorial review and revision. *Pi in the Sky* is mailed to schools in Alberta, B.C., and Washington State. Individuals may request a copy of *Pi in the Sky* magazine by sending their mailing address to pi@pims.math.ca.

All issues of *Pi in the Sky* can be downloaded for free from the Pi in the Sky web page.

Significant funding for *Pi in the Sky* is provided by Alberta Innovation and Science

Pi in the Sky can be downloaded for free.

www.pims.math.ca/pi



PIMS NEWSLETTER 10.2



Volume 10 Issue 2 Winter 2007

Looking Towards the Future

This is a 10P anniversary issue and the question naturally arises: what is PIMS going to look like in 10 years? More generally, what is the scientific world going to look like in 2017?

It seems to us that, by that time, problems arising from the global effects of human activity will feature much more prominently in the scientific agenda than they do now. Understanding and mitigating global warming, resource scarcity, biodiversity and natural resources, preventing new infectious diseases from arising and spreading, creating the conditions of fair economic development and just societies around the world, all these challenges will have to be dealt with, and all of them have been components of mathematical modeling.

This is where PIMS wants to go. These are the CRGs we will engage in 2007 as oriented towards the environment. Just an incident, in fact we recently by itself can make a significant contribution to solving each problem. This is really a problem for global scientific networks, stretching across oceans and boundaries. PIMS by itself is a regional network, and we are now associating with others to create international networks. In 10 years, we hope that the PIMS network, which is barely one year old, will have become a global network for training and research in emerging areas of mathematics. We also hope that PIMS will have become an active part of the CRMS network and through the CRMS a member of the European research community. In this way PIMS will stand as a gateway, a crossroads between the Pacific Rim, the American and Europe, bridging different mathematical traditions in solving global problems. Let this be our wish for the future.



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Fields Medals 2006

The 2006 Fields Medals were awarded on Aug. 22, 2006, at the International Congress of Mathematicians in Madrid. The winners are: Andrei Okounkov, for his contributions to linking probability, representation theory and algebraic geometry; Cédric Villani, for his contributions to geometry and his work on the transition from the analytical and geometric structure of the Ricci flow (Dr. Perelman declined to accept the medal); Thomas Tao, for his contributions to partial differential equations, combinatorics, harmonic analysis and additive number theory; and Wendelin Werner, for his contributions to the development of stochastic Loewner evolution, the geometry of two-dimensional Brownian motion, and conformal field theory.



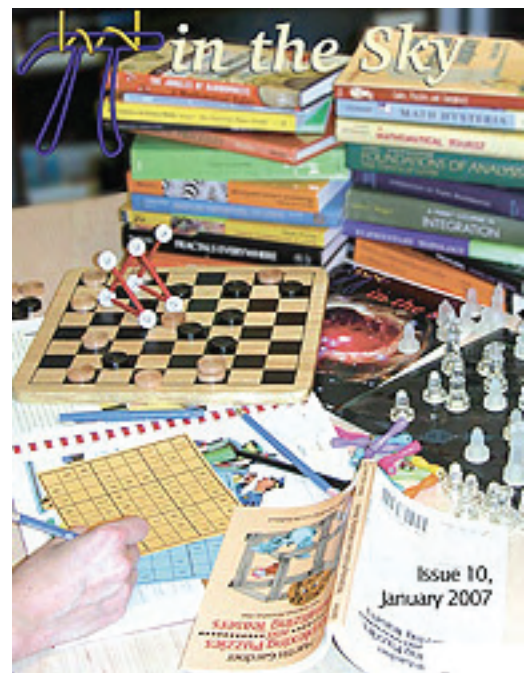
PIMS partners with Clivestay

PIMS is pleased to announce a new collaboration agreement with Clivestay, the Center for Investigative Studies, Research, and Advanced Study, Missouri.

As part of the agreement, PIMS and Clivestay will collaborate on research projects in the mathematical sciences. The institutes plan to hold joint events and conferences to facilitate the exchange of resources and knowledge between Canada, the USA, and Mexico. <http://www.clivestay.com>



Four New CRGs Approved by PIMS Scientific Review Panel
Please see page 3



COVER IMAGE

Assorted games and puzzles to make mathematics fun for everyone.

FINANCIAL REPORTS

PIMS Total Income: April 1, 2006, to March 31, 2007

| Source | Est. carryforward from 2005-06 | Income | Operating Funds 2006-07 |
|---|--------------------------------|--------------------|-------------------------|
| Income | | | |
| NSERC | \$1,162,000 | \$1,017,100 | \$2,179,100 |
| BC Government - Est. | \$119,657 | \$127,805 | \$247,462 |
| Alberta Government (Grant at UA) - Est. | \$0 | \$178,108 | \$178,108 |
| Alberta Government (Grant at UC) - Est. | \$0 | \$179,690 | \$179,690 |
| PIMS Partner Universities | (\$67,000) | | (\$67,000) |
| Simon Fraser University | \$0 | \$75,000 | \$75,000 |
| University of Alberta | \$0 | \$70,000 | \$70,000 |
| University of British Columbia | \$24,951 | \$220,000 | \$244,951 |
| University of Calgary | \$0 | \$61,000 | \$61,000 |
| University of Victoria | \$0 | \$60,000 | \$60,000 |
| University of Washington | \$0 | \$10,000 | \$10,000 |
| University of Lethbridge | \$0 | \$5,000 | \$5,000 |
| University of Northern British Columbia | \$0 | \$0 | \$0 |
| University of Regina | \$0 | \$7,500 | \$7,500 |
| Subtotal from Partner Universities | (\$42,049) | \$508,500 | \$466,451 |
| MITACS NCE | \$47,451 | \$80,117 | \$127,568 |
| BC-NCE Infrastructure | \$26,884 | \$0 | \$26,884 |
| BC Government 1-time Funding | \$0 | \$130,000 | \$130,000 |
| Other Funding | \$75,477 | \$98,531 | \$174,008 |
| TOTAL Income | \$1,389,420 | \$2,319,851 | \$3,709,271 |

PIMS Summary of Expenditures: April 1, 2006 to March 31, 2007

| Description | Budget 2006-2007 | Actual 2006-2007 | Variance 2006-2007 |
|------------------------------------|--------------------|--------------------|--------------------|
| Expense by Funding Source | | | |
| NSERC | \$2,160,172 | \$1,571,196 | \$ 588,976 |
| BC Government (CSE, formerly ISTA) | \$ 286,000 | \$ 102,646 | \$ 183,354 |
| Alberta Government (Grant at UA) | \$ 56,050 | \$ 96,020 | \$ (39,970) |
| Alberta Government (Grant at UC) | \$ 47,450 | \$ 7,856 | \$ 39,594 |
| PIMS Partner Universities | \$ 538,900 | \$ 746,720 | \$ (207,820) |
| MITACS NCE | \$ 83,625 | \$ 80,758 | \$ 2,867 |
| BC-NCE Infrastructure | \$ 38,000 | \$ - | \$ 38,000 |
| Other Funding | \$ 38,500 | \$ 131,501 | \$ (93,001) |
| BC Government Special Grant | \$ 48,000 | \$ - | \$ 48,000 |
| Total Expenses | \$3,296,697 | \$2,736,697 | \$ 560,000 |