Pacific Institute for the Mathematical Sciences

Annual Report 2004/05

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, University of Victoria) with the objectives of:

- Promoting research in mathematics
- Strengthening ties and collaboration between the 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
- Creating strong mathematical partnerships and links within Canada and with organizations in other countries, focusing on the nations of the Pacific Rim

PIMS has a close partnership with the University of Washington and the Mathematical Sciences Research Institute (MSRI), and the Universities of Lethbridge and Northern British Columbia are affiliates.

In its eight years of existence PIMS has developed various ways in which to fulfil the objectives set by its founding universities. These include the 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 science and education.

Ivar Ekeland
Director, PIMS

Overview

Ivar Ekeland, PIMS Director

Ivar Ekeland,
PIMS Director

The major event of the 2004-5 period has undoubtedly been the renewal of the Banff International Research Station (BIRS). PIMS has led an international team of major institutions in putting together the new proposal. Our partnership with MSRI has now been extended to UNAM (Mexico), and to MITACS.

We hope that BIRS will become a bridge between the Canadian and Mexican mathematical communities, and that PIMS universities will be active in developing collaborations with UNAM and other Mexican institutions, nichas cinvestav.

BIRS is now a truly international institution, supported by NSERC, the Alberta government, NSF and the Mexican CONACYI– the scientific Advisory Board and the Programme Committee are independent from PIMS, and it is no longer the case that PIMS has the right to pre-empt a certain number of weeks. This cancels the direct advantage that PIMS derives from BIRS, however it remains the case that the presence of BIRS in Banff draws to Western Canada, and particularly to Alberta, a steady flow of world-class scientists. This is why PIMS will continue to shoulder the burden of administrating BIRS, as a service to the Canadian mathematical community.

I will also like to point out that the International Congress on Industrial and Applied Mathematics (ICIAM) will be held in Vancouver in 2011, thanks to a successful bid put together by MITACS, together with SIAD and CAIMS.

In 2005-06, we will try to build on the many international contacts we have made this year. Our mandate calls for developing ties with the Pacific Rim communities–this is the next way to go.

Contents

PIMS PERSONNEL

The staff from the PIMS sites together for a training meeting at UBC in November 2004.

PIMS Management

Board of Directors

The Board of Directors has final responsibility for all aspects of the PIMS' operation. In particular, the Board ensures fiscal accountability, monitors the operation of the PIMS, and advises the Executive Committee.

Michael Boorman.

Chair of the Board: Dr. Michael Boorman recieved his Ph.D. from the University of Nottingham in 1964, and is a professor in the Chemistry Department at the University of Calgary. Currently, he is the Dean of Science at the University of Calgary. Dr. Boorman's research activities are in Inorganic Chemistry and in Heterogeneous Catalysis

Donald Brooks.

Dr. Donald 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.

Don Denney.

Dr. Don Denney received his Ph.D. from the University of Waterloo in 1978 and spent two years as a post-doctoral fellow at the University of Colorado engaged in atmospheric chemistry studies and in developing statistical pattern recognition techniques. He is a Director of PRECARN/IRIS, serving as Board Chair for 1999/2000. Don has been with Syncrude for 24 years and is currently Manager, Process Automation Services providing process automation support to Syncrude's Mining, Extraction, Utilities and Upgrading operations in Fort McMurray, Alberta. Don's prior experience at Syncrude includes 10 years at Research developing On-Line Sensors and applying Pattern Recognition techniques to data analysis and 8 years as Manager Information Services. His current interest is applying mathematical techniques to determining process unit health and providing advanced warning to process operators to avoid downgrading incidents.

Ivar Ekeland.

Dr. Ivar Ekeland is the Canada Research Chair in Mathematical Economics at the University of British Columbia. He is a former President of Universite 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 Poincare-Analyse nonlineaire" 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 Societe Mathematique 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.

Mr. Haig Farris practiced as a lawyer with Farris and Company for 5 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, 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


Haig Farris.

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 Farris' sense of vision and leadership: he leads by example and is living proof that individual attitudes and behaviour can make a difference. On campus, 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 is the Vice-President (Research) and Professor (Department of Renewable Resources) at the University of Alberta. From 1996-2001 he was Dean, College of Graduate Studies and Research, and Professor at the University of Saskatchewan. He received his B.Sc. (honors Biology 1976) and M.Sc. (Soil Science 1980) from the University of Saskatchewan, and his Ph.D. (Soil Physics 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.


Gary Kachanokski.

Dr. Mark Lewis is a faculty member at the University of Alberta where he is the Senior Canada Research Chair in Mathematical Biology and directs the Centre for Mathematical Biology. He 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. Lewis has served on a number of advisory boards, including and 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). Lewis' research is in mathematical biology and ecology, including modeling 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 Mt. St. Helens. He has been a member of the PIMS Board of Directors since 2004.


Mark Lewis.

Dr. 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 Programme. 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 both the Geoscience Council of Canada and the Geological Association of Canada, and was also Treasurer of the Canadian Geological Foundation from 1987 to 1996. He is a member of the Geological Society of London, the Institute of Mining and Metallurgy, UK, the Canadian Institute of Mining and Metallurgy, the Association of Professional Engineers of BC and a number of other scientific and professional associations.

Hugh Morris.

Dr. Edwin Perkins is Professor of Mathematics at the University of British Columbia where he was first appointed as a postdoctoral fellow in 1979. He did is his undergraduate degree at U. of Toronto and obtained his doctoral degree from the U. of Illinois. His research interests in probability include the general theory of processes, Brownian motion, stochastic differential equations and partial differential equations, interacting particle systems, measure-valued diffusions and stochastic models in population genetics. He has won numerous awards for his research including the Coxeter-James Lectureship (1986), G. de B. Robinson Award (1996) and Jeffery-Williams Prize (2002) (Canadian Math. Society), the Rollo Davidson Prize (1983) (Cambridge U.) and a Steacie Fellowship (1992-93) (NSERC). He is a Fellow of the Royal Society of Canada and the Institute of Mathematical Statistics and presently sits on the editorial Boards of the Annales de l'Institut Henri Poincare, Stochastic Processes and Their Applications and the Electronic Journal of Probability. He has given several invited lectureships including an invited address at the 1994 International Congress of Mathematicians in Zurich.

Edwin Perkins.

Dr. B. Mario Pinto was born in Colombo, Sri Lanka and received his B.Sc. degree in Chemistry and Ph.D. from Queen's University. Dr. Pinto served as Chair of the Chemistry Department from 1999-2004, and is currently Vice-President, Research at Simon Fraser University. Dr. Pinto received the 1992 Horace S. Isbell Award of the American Chemical Society, the 1993 Merck Frosst Award of the Canadian Society for Chemistry (CSC), and the 2002 Bernard Belleau Award of the CSC. He is a Fellow of the Chemical Institute of Canada, and was elected to the Academy of Sciences of the Royal Society of Canada in 2003. Dr. Pinto is a pioneer in the field of chemical biology having developed novel NMR/molecular modeling protocols for protein structure determination and the study of ligand topographies essential for drug and vaccine design. He was recently awarded a patent for his breakthrough on the effect of glycosidase inhibitors as novel therapeutic agents for Type 2 diabetes, which has proven effective in lowering blood glucose levels in rats. He is founder of the company, Mimos Therapeutics, Inc. He has been a member of the PIMS Board of Directors since 2004.

B. Mario Pinto.

Dr. Brian Russell 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, Brian joined Teknica Resources Development in Calgary as a senior geophysicist. In 1983 he moved to Veritas Seismic Ltd. in a research and training position. In 1987, Brian, 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

Brian Russell.

subsidiary of Veritas DGC Inc, where Brian is currently Vice President. Brian is still actively involved in both 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. Brian 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 SG, the Society of Exploration Geophysics, Brian 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, Brian and Dan Hampson were jointly awarded the SEG Enterprise Award. He has been a member of the PIMS Board of Directors since 2004, and Chair since 2005

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 spin-off 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 Insitute's motto "The fundamental things apply". 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.

Dennis Salahub.

Dr. Martin Taylor moved to the University of Victoria 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 University in 1974. He was Chair of Geography (1991-1997), founding Director of the Institute of Environment and Health (1991-96), 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 contamination and on community-based heart health promotion. He has authoured one book and over 100 papers in peer-reviewed journals.

Martin Taylor.

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 1983-85, 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

Hugh Williams.

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 1993-4. 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

The Scientific Review Panel is responsible for:
- The review and selection of scientific programmes and determination of their funding levels
- The selection of PIMS Distinguished Chairs and the PIMS Research Prize
- Provide advice on long-term scientific planning for PIMS

The members are:

Dt. Alejandro Adem is a Professor of Mathematics at UBC. In 1982 he received his BS from the National University of Mexico, and in 1986 he received his Ph.D. from Princeton University, under Bill Browder. After holding a Szegö 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 UBC in 2004. 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.

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.

Adem served as Chair of the Department of Mathematics at UW-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 Alejandro 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 a member of the PIMS SRP since 2005.

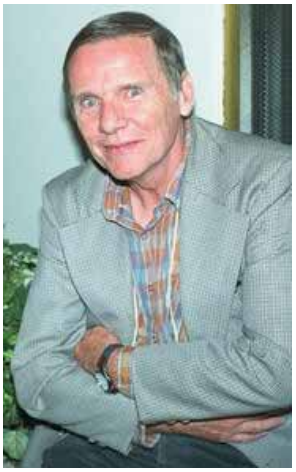
Dr. David Brydges received the PhD in 1976 at the University of Michigan under the direction of Paul Federbush. He held a postdoctoral position at Rockefeller University working for James Glimm. In 1978 he became Assistant Professor at the University of Virginia. He was promoted to Full Professor of Mathematics and Physics in 1981 and became Commonwealth Chair in 1996. In 2001 he was appointed as a Canada Research Chair at the University of British Columbia.

David Brydges.

Brydges received the Alfred P. Sloan Research fellowship in 1982. He has given lectures throughout the world including courses in the Troisiéme Cycle at Lausanne in 1992, Centre Emile Borel in 1998 and the NachDiplom program at ETH,Switzerland. He is the President of the International Association of Mathematical Physics.

His interests are centred in the renormalization group with applications to quantum field theory, statistical mechanics and probability.

Dr. David Brillinger's research is in statistical inference and applications to stochastic processes. In particular this involves him in statistical methods for random processes and in science and engineering. He has made contributions to the theory and application of statistics in subject areas including neurophysiology (the analysis of neutral spike trains), seismology, and the modelling animal tracks. He is the author of Time Series Analysis: Data Analysis and Theory, former editor of the International Statistical Society of Canada. He is a member of the American Academy of Arts and Sciences and is a Fellow of the Royal Society of Canada. He recieved a D. Sc. degree from the University of Western Ontario in 1999 and a D. Math. degree from the University of Waterloo in 2003.



David Brillinger.

Ivar Ekeland.

Dr. Ivar Ekeland is the Canada Research Chair in Mathematical Economics at the University of British Columbia. He is a former President of Universite 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 Poincare-Analyse nonlineaire" 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 Societe Mathematique de France. He is also a regular contributor to the journal "Nature" as well as to the magazine "Pour la Science".

Dr. 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), M.Sc. (Computing Science), and Ph.D. (Computer Science) from the Universities of Regina, Alberta, and British Columbia, respectively.

Randy Goebel.

Professor 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 know, and his recent application of practical belief revision to scheduling and web mining is now having industrial impact. Randy has previously held faculty appointments at the University of Waterloo and the University of Tokyo, and is actively involved in academic and industrial collaborative research projects in Canada, Australia, Europe and Japan.

Dr. Ronald Graham is the Irwin and Joan Jacobs Professor of Computer and Information Science in the Computer Science and Engineering Department of the University of California at San Diego. He is also currently President of the Mathematical Association of America and has served as the Treasurer of the National Academy of Sciences since 1996. He was also the President of the American Mathematical Society from 1993 to 1995, and served as Chief Scientist of AT & T Labs until 1999. Graham's academic awards include membership in the National Academy of Arts and Sciences, Fellow of the America Association for the Advancement of Science, Fellow of the Association of Computing Machinery, and recipient of the Polya Prize in Combinatorics, the Euler Medal in Combinatorics, a Lester Ford Award of Math. Assoc. of America, a Carl Allendorfer Award of the Math. Assoc. of America, and the Leroy Steele Award for Lifetime Achievement from the American Mathematical Society in 2002. He has also served as President of the International Jugglers Association. Graham's current mathematical interests include combinatorics, number theory, graph theory, discrete and computational geometry, design and analysis of algorithms, and applications thereof.

Ronald Graham.

Dr. 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 Andre Aisenstadt prize. He is a Fellow of the Royal Society of Canada.

Ian Putnam.

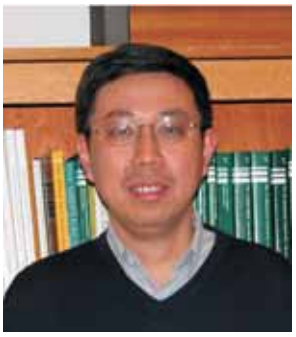
Dr. Bob Russell received the Ph.D. in 1971 at the University of New Mexico under the direction of Lawrence Shampine. In 1971 he became Assistant Professor at Colorado State University and in 1972 he moved to Simon Fraser University. He was promoted to Full Professor in 1981. He has held numerous visiting positions throughout the world, including at Stanford, University of Auckland and Imperial College (as an SERC Fellow).

Bob Russell.

Russell's travels include as an Invited Scholar at the USSR and Chinese Academies of Science and as a plenary speaker at SIAM's Dynamical Systems Conference in 2000. His journal editorships have included SIAM Journal on Numerical Analysis and SIAM Journal for Scientific Computing. He is a founding member and past Vice President of CAIMS, 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. An interest is in dynamical systems and computational methods which preserve qualitative features of solutions of differential equations. This has recently been in the context of developing mathematical software using adaptive gridding techniques.

Dr. 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 full professor in 1992. He is currently a J. Simons professor at the Massachusetts Institute of Technology. Professor Tian is a recipient of the Alfred P. Sloan research fellowship (1991-1993). He presented a 45-minutes invited address at the International Congress of Mathematicians in Kyoto in 1990 and a plenary address at the International COmgress of Mathematics in Beijing in 2002. In 1994, he received the 19th Alan Waterman Award from the National Science Foundation. In 1996, Professor Gang Tian received the Veblen Prize of the American Mathematical Society.



Gang Tian

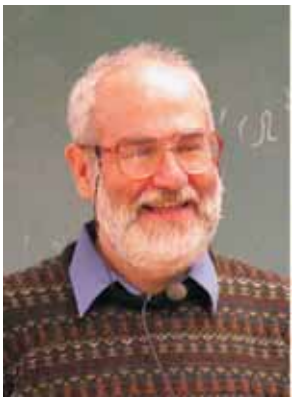
Dr. Elizabeth Thompson received a B.A. in Mathematics (1970), a Diploma in Mathematical Statistics (1971), and Ph.D. in Statistics (1974), from Cambridge University. In 1974-5 she was a NATO/SRC post-doc in the Department of Genetics, Stanford University. From 1975-81 she was a Fellow of King's College, Cambridge, and from 1981-5 was Fellow and Director of Studies in Mathematics at Newnham College. From 1976-1985 she was a University Lecturer in the Department of Pure Mathematics and Mathematical Statistics, University of Cambridge. She joined the faculty of the University of Washington in December 1985, as a Professor of Statistics. Since 1988, Dr. Thompson has been Professor also of Biostatistics, and since Spring 2000, she is also an Adjunct Professor in Genetics (now Genome Sciences) at the University of Washington, and an Adjunct Professor of Statistics at North Carolina State University. She served as Chair of the Department of Statistics from 1989-94.

Elizabeth Thompson.

In 1981, she was elected a member of the International Statistical Institute, and in 1988, she was awarded an Sc.D. degree by the University of Cambridge. In 1994, she gave the R.A. Fisher Lecture at the Joint Statistical Meetings in Toronto. In 1996, she gave the Neyman Lecture (IMS) at the Joint Statistical Meetings in Chicago. In 1998, she was elected a Fellow of the American Academy of Arts and Sciences. In 2001, she received the inaugural Jerome Sacks Award for Cross-Disciplinary Research from the National Institute for Statistical Science, and was also awarded the Weldon Prize, an international prize for contributions to Biometric Science awarded by the University of Oxford.

Dr. Thompson's research interest is in the development of methods for inference from genetic data, and particularly from patterns of genome sharing observed among members of large and large and complex pedigree structures, whether of plants, animals, or humans. Questions of interest range from human genetic linkage analysis to gene extinction in highly endangered species, and from inference of relationship to inferences of the genetic basis of traits, Her current focus is on developing research and education in Statistical Genetics at the University of Washington.

Dr. Gunther Uhlmann received the 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 Full Professor in 1987.

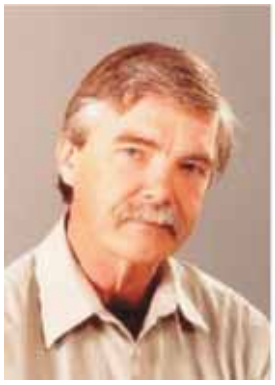


Gunther Uhlmann.

Uhlmann was awarded the Annual National Prize of Venezuela in Mathematics in 1982. He received the Alfred P. Sloan Research fellowship in 1984 and a John Simon Guggenheim fellowship in 2001. He was named Corresponding member of the Chilean Academy of Sciences in 2001. He has given numerous lectures throughout the world included 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.

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 algo-



Hugh Williams.

rithms 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 1993–4. He has also been a member of the Steacie Awards Selection Committee.

Executive Commitee

The Executive Committee consists of the Director, the five Site Directors, and other members appointed by the Board as required. The Executive is responsible for the day to day management of the PIMS as delegated by the Board.

Director: Ivar Ekeland (UBC, Math & Econ)
Deputy Director: Alejandro Adem (UBC, Math)
SFU Site Director: Manfred Trummer (SFU, Math)
UA Site Director.: Gerald Cliff (UA, Math)
UC Site Director.: Gemai Chen (UC, Math)
UVic Site Director: Christopher Bose (UVic, Math)
UW Site Director.: Gunther Uhlmann (UW, Math)

Education and Communication

Education Facilitator: Klaus Hoechsmann (UBC)
SFU Education Coordinator: Malgorzata Dubiel
UA Education Coordinator: Jack Macki
UC Education Coordinator: Indy Lagu
UVic Education Coordinator: David Leeming
Publications and Communications Manager: Heather Jenkins
PIMS Website Manager: Kelly Choo

National Programme

PIMS has partnered with le Centre de Recherches Mathématiques (CRM) and the Fields Institute for Research in Mathematical Sciences (Fields) to support two national initiatives: a mathematics association for Atlantic Canada (AARMS), and the NPCDS statistics initiative. All geographical areas of the country now fall under the mandate of one of these groups.

The National Programme Committee of the Institutes now consists of the Directors of PIMS, the CRM and Fields (or their designates). Proposals for any part of Canada will be reviewed by this body.

PIMS Site Personnel

PIMS Central Office

Dr. Ivar Ekeland, Director
Dr. Alejandro Adem, Acting Deputy Director
Mrs. Shelley Alvarado, Chief Operations Officer
Ms. Fanny Lui, PIMS Administrator
Mr. Chee Chow, Financial Officer
Ms. Heather Jenkins, Communications and Publications Manager
Mr. Ken Leung, Programme Coordinator
Ms. Danny Fan, Secretary
Ms. Clarina Chan, MITACS Administrator for PIMS-UBC
Dr. Klaus Hoechsmann, Education Facilitator
Mrs. Melania Alvarez-Adem, BC Education Coordinator
Mr. Brent Kearney, Manager Computer Systems
Mr. Kelly Choo, WebsiteManager
Mr. Shervin Teymouri, Computer Systems Administrator

PIMS at Simon Fraser University

Dr. Manfred Trummer, Site Director
Ms. Margaret Gardiner Administrative Assistant
Mr. Shahin Teymouri, PIMS/MITACS Computer Systems Administrator
Dr. Malgorzata Dubiel, Education Coordinator
Dr. Jan Manuch, PIMS PDF
Dr. Christopher Rowe, PIMS PDF (joint with UBC)
Dr. Jian-Jun Xu, PIMS PDF
Dr. Ronald Ferguson, MITACS PDF (joint with UBC)
Dr. Freidrich Littman, PIMS PDF (joint with UBC)
Dr. Boaz Ben-Moshe, PIMS PDF
Dr. Antonia Kolokolova, PIMS PDF
Dr. Youngsuk Lee, PIMS PDF
Dr. Wilson Lu, PIMS PDF
Dr. Jens Rademacher, PIMS PDF (joint with UBC)

Manfred Trummer, PIMS-SFU Site Director, 2001–05.

PIMS at University of British Columbia

Dr. Dominic Brecher, PIMS PDF
Dr. Ben Green, PIMS PDF
Dr. Jae-Hun Jung, PIMS PDF
Dr. Kyungkeun Kang, PIMS PDF
Dr. Freidrich Littmann, PIMS PDF (joint with SFU)
Dr. Christopher Rowe, PIMS PDF (joint with SFU)
Dr. Jacob Shapiro, PIMS PDF
Dr. Jianying Zhang, PIMS PDF
Dr. Paul Chang, MITACS PDF
Dr. Omer Angel, PIMS PDF
Dr. Shlomo Hoory, PIMS PDF
Dr. Mario Pineda-Krch, PIMS PDF
Dr. Jens Rademacher, PIMS PDF (joint with SFU)
Dr. Ronald Ferguson, MITACS PDF (joint with SFU)
Dr. John Walsh, POC/MITACS

PIMS at University of Alberta

Dr. Gerald Cliff, Site Director
Ms. Shirley Mitchell, Administrative Assistant
Dr. Jack Macki, Education Coordinator
Dr. Frithjof Lutscher, PIMS PDF (joint with UC)
Dr. Suneeta Vardarajan, PIMS PDF
Dr. Hosne Ara Jasmine, PIMS PDF

Gerald Cliff,
PIMS-UA Site Director,
2004–05.

PIMS at University of Calgary

Dr. Gemai Chen, Site Director
Dr. Gary Margrave, PIMS Industrial Facilitator
Ms. Marian Miles, Administrative Assistant
Dr. Indy Lagu, Education Coordinator
Dr. Lyonell Boulton, PIMS PDF
Dr. Frithjof Lutscher, PIMS PDF (joint with UA)
Dr. Anne-Gaelle Rolland-Lagan, PIMS PDF
Dr. Hugh Geiger, MITACS PDF
Dr. Elena Kudryavtseva, PIMS Visiting Research Fellow
Dr. Jonathan Walgate, PIMS PDF

Gemi Chen,
PIMS-UC Site Director,
2004–05.

PIMS at University of Victoria

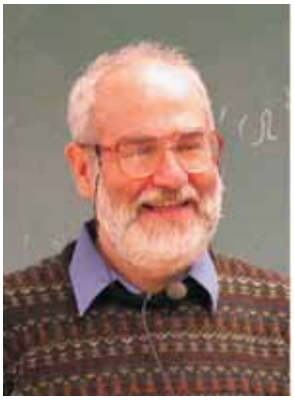
Dr. Christopher Bose, Site Director
Ms. Dil Bains, Administrative Assistant
Dr. David Leeming, Education Coordinator
Mr. Kelly Choo, Web Manager
Dr. Bahram Rangipour, PIMS PDF
Dr. Wael Bahsoun, PIMS PDF

Christopher Bose,
PIMS-UVic Site Director,
2004–05.

PIMS University of Washington

Dr. Gunther Uhlmann, Site Director
Ms. Mary Sheetz, Administrative Assistant

Gunther Uhlmann,
PIMS-UW Site Director,
2003–05.



Banff International Research Station

Dr. Nassif Ghoussoub, BIRS Scientific Director
Ms. Shelley Alvarado, BIRS Managing Director
Mrs. Andrea Lundquist, BIRS Station Manager (on leave)
Ms. Brenda Shakotko, BIRS Station Manager
Ms. Kathryn Wood, BIRS Programme Coordinator
Ms. Danny Fan, BIRS Administrative Assistant
Mr. Brent Kearney, BIRS Systems Administrator
Ms. Natalia Gartley, BIRS Administrative Assistant

PIMS Scientific Personnel

PIMS Distinguished Chairs for 2004/05

Chris Budd (University of Bath)
Site: Scientific Computing CRG at Simon Fraser University
July 2004

Roger A. Fenn (Sussex University)
Site: Topology CRG at University of British Columbia
April 2004

Andras Hajnal (Rutgers University)
Site: Univeristy of Calgary
September - October 2004

Sergei Konyagin (Moscow State University)
Site: Number Theory CRG at University of British Columbia
April-May 2004

Bjorn Poonen (University of California, Berkeley)
Site: Number Theory CRG at Simon Fraser Univeristy
June-July 2004

Otmar Scherzer (University of Innsburck, Austria)
Site: Scientific Computing CRG at UBC
July - September 2004

Yaozhong Hu (Univeristy of Kansas)
Site: Probability CRG at University of Alberta
August 2004- August 2005

Richard Bass (University of Connecticut)
Site: Probability CRG at Univeristy of British Columbia
September 2004- August 2005

Roger Nisbet (University of California, Santa Barbara)
Site: Math Ecology CRG at University of Alberta and University of Calgary
September -October 2004

Dan Rudolph (University of Maryland)
Site: Dynamics CRG at University of Victoria
October 2004

See page 38 for more information about the PIMS Distinguished Chairs for 2004/05.

PIMS Postdoctoral Fellows for 2004/05

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

Wael Bahsoun: *Measurable Dynamics*
Supervised by Chris Bose (University of Victoria)

Boaz Ben-Moshe: *Computational Geometry*
Supervised by Binay K. Bhattacharya (Simon Fraser University)

Shlomo Hoory: *Expander Graphs*
Supervised by Joel Friedman (UBC)

Hosne Ara Jasmine: *Mechanics*
Supervised by Bruce R. Sutherland (University of Alberta)

Antonia Kolokolovna: *Computational Logic*
Supervised by Eugenia Ternovska (Simon Fraser University)

Youngsuk Lee: *Atmospheric Modelling*
Supervised by Mary Catherine Kropinski and David Muraki (Simon Fraser University)

Wilson Lu: *Statistics*
Supervised by Derek Bingham (Simon Fraser Univeristy)

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

Jens Rademacher: *Dynamics/Scientific Computing*
Supervised by Michael Ward (UBC) and Ralf Wittenberg (Simon Fraser Univeristy)

Jonathan Walgate: *Quantum Information Science*
Supervised by Barry C. Sanders (University of California)

See page 41 for more information about the PIMS Postdoctoral Fellows for 2004/05.

THE BANFF INTERNATIONAL RESEARCH STATION

The Banff Centre from the air. Photo courtesy of Robert Piché.

Nassif Ghoussoub, BIRS Scientific Director.

The Banff International Research Station is a collaborative effort between the Pacific Institute for the Mathematical Sciences (PIMS) and the Mathematical Sciences Research Institute (MSRI). Funding comes from the Canadian government through NSERC (grant to PIMS), the Alberta government through ASRA (grant to PIMS), the US government through NSF (grant to MSRI), and from MITACS. The administration of BIRS is performed by PIMS.

BIRS is located in Corbett Hall and the Max Bell Building of The Banff Centre in Banff, Alberta. More than 1700 researchers will attend 5-day workshops, 2-day workshops, research in teams, focused research groups and summer schools over 40 weeks of operation in 2003.

The Location of BIRS

BIRS is located in two adjacent buildings at the Banff Centre: the Max Bell building will have two lecture rooms and several smaller meeting and discussion rooms, and Corbett Hall, which will be entirely taken over by BIRS, will house the living quarters for all BIRS visitors.

Modes of Operation

Five-Day Workshops

The fundamental mode of BIRS is the five-day workshop, which runs from Sunday a.m. through to Thursday p.m. Each workshop is devoted to one specific area of high research interest. About 40 expert participants from around the world are invited to attend. The objective is to exchange the latest advances in the field and to provide an environment which fosters new collaborations and new ideas, and which provides a forum for lively and vigorous discussion for the latest theories and proposals.

Two-day Workshops

The normal scheduling of the five-day workshops will leave 2 day periods open (Friday and Saturday) that may be used for a variety of shorter meetings such as Pacific Northwest Seminars and special events.

The BIRS Scientific Advisory Board

Research in Teams

In addition to its ongoing workshops, the station may host teams of 2–4 researchers for periods of 2–4 weeks. This programme will offer individuals from different institutions who are collaborating together, the location and freedom from distraction to concentrate on their research or to finish major projects.

Focused Research Groups

There will be possibilities to have research collaborative groups in residence together for longer stays (Aspen mode) and some with other formats. A typical configuration might be groups of 10–15 mathematicians each, up to 8 of them being in residence at BIRS for 2–4 weeks. This would provide a good venue for collaborative work for teams of mathematical researchers like those identified and supported by NSF's Focused Research Groups program and NSERC's Collaborative Research Opportunities program.

Summer Schools

BIRS will run some longer events (10–12 days) in the form of research schools directed principally towards graduate students and postdoctoral fellows.

BIRS Calendar for 2004

2004 Programme for 5-day Workshops

Mar 13–18: **Interactions between model theory and geometry**
Organizers: Deirdre Haskell (McMaster U.), Jan Denef (Leuven), Ehud Hrushovski (Hebrew U.), Angus Macintyre (Edinburgh), Anand Pillay (UIUC), Patrick Speissegger (Wisconsin & McMaster U.)

Mar 20–26: **Topology of Manifolds and Homotopy Theory**
Organizers: Ian Hambleton (McMaster U.), Erik Pedersen (SUNY Binghamton), Gunnar Carlsson (Stanford)

Mar 27–Apr 1: **Orthogonal Polynomials; Interdisciplinary Aspects**
Organizers: Jacek Szmigielski (U. Saskatchewan), Percy Deift (Courant Inst. of Mathematical Sciences), Lance Littlejohn, David Sattinger (Utah State U.)

Apr 3–8: **Model Reduction Problems and Matrix Methods**
Organizers: Anne Greenbaum (U. Washington), Gene Golub (Stanford), Jim Varah (UBC)

Apr 10–15: **Analytic and Geometric Aspects of Stochastic Processes**
Organizers: Martin Barlow (UBC), Alexander Grigoryan (Imperial College, London), Elton Hsu (Northwestern U.)

Apr 17–22: **BIRS Workshop in Creative Scientific Writing**
Organizers: Marjorie Senechl (Smith College), Chandler Davis (U. Toronto)

Apr 17–22: **Celestial Mechanics** (1/2 workshop)
Organizers: Florin Diacu (U. Victoria), Donald Saari (UC Irvine)

Apr 24–29: **Microeconometrics of Spatial and Grouped Data**
Organizers: Thomas Lemieux (UBC), David Card (UC Berkeley)

May 1–6: **Mathematical Structures in Economic Theory and Econometrics** (1/2 workshop)
Organizers: Ivar Ekeland (UBC), Pierre-Andre Chiappori (U. Chicago)

May 1–6: **Singular Cardinal Combinatorics** (1/2 workshop)
Organizers: Claude Laflamme (U. Calgary), Matthew Foreman (UC Irvine), Stevo Todorcevic (U. Toronto & CNRS Paris)

May 8–13: **Knots and their Manifold Stories**
Organizers: Orr Kent (Indiana U.), Tim Cochran (Rice U.), Dale Rolfsen (UBC)

May 15–20: **New Developments on Variational Methods and their Applications**
Organizers: Kung-Ching Chang (Peking U.), Jingyi Chen (UBC), Changfeng Gui (U. Connecticut), Paul Rabinowitz (U. Wisconsin, Madison)

May 22–27: **Mathematical Foundations of Scientific Visualization, Computer Graphics, and Massive Data Exploration**
Organizers: Torsten Moller, Robert Russell (SFU), Bernd Hamann (UC Davis)

May 29–Jun 3: **Aperiodic Order: Dynamical Systems, Combinatorics, and Operators**
Organizers: Michael Baake (Institut fuer Mathematik), David Damanik (Caltech), Ian Putnam (U. Victoria), Boris Solomyak (U. Washington)

Jun 5–10: **Semimartingale Theory and Practice in Finance**
Organizers: Tom Hurd (McMaster U.), Thaleia Zariphopoulou (U. Texas, Austin), Philip Protter (Cornell U.), Lane Hughston (King's College London)

Jun 12–17: **New Horizons in String Cosmology**
Organizers: James Cline (McGill U.), Robert Brandenberger (Brown U.), Steve Giddings (UC Santa Barbara), Brian Greene (Columbia U.), Rob Myers (Perimeter Institute), Gordon Semenoff (UBC)

Jun 19–27: **PIMS-MITACS-MSRI Special Program on Infectious Diseases Summer School**
Organizers: Fred Brauer (UBC), Mark Lewis (U. Alberta), Pauline van den Driessche (U. Victoria), James Watmough (U. New Brunswick), Jianhong Wu (York U.), Ping Yan (Health Canada)

Jun 27–Jul 2: **PIMS-MITACS-MSRI Special Program on Infectious Diseases**
Organizers: Fred Brauer (UBC), Mark Lewis (U. Alberta), Pauline van den Driessche (U. Victoria), James Watmough (U. New Brunswick), Jianhong Wu (York U.), Ping Yan (Health Canada)

Jul 4–8: **Advances in Complexity Theory**
Organizers: Valentine Kabanets (SFU), Stephen Cook (U. Toronto), Arvind Gupta (SFU), Russell Impagliazzo (UC San Diego), Madhu Sudan (MIT), Avi Wigderson (Institute for Advanced Study, Princeton).

Jul 10–15: **Convex Geometric Analysis**
Organizers: Nicole Tomczak-Jaegermann (U. Alberta), Vitali Milman (Tel Aviv U.), Elisabeth Werner (Case Western Reserve U.)

Jul 17–22: **Modeling Protein Flexibility and Motions**
Organizers: Walter Whiteley (York U.), Michael Thorpe, Leslie Kuhn (Michigan State U.)

Jul 24–29: **Geometric Evolution Equations**
Organizers: Christine Guenther (Pacific University), Jingyi Chen (UBC), Bennett Chow (UC San Diego), Klaus Ecker (Freie Universitaet Berlin)

Jul 31–Aug 5: **Conformal Geometry**
Organizers: Thomas Branson (U. Iowa), Michael Eastwood (U. Adelaide, Australia), McKenzie Wang (McMaster U.)

Aug 7–12: **Stochastic Processes in Evolutionary and Disease Genetics**
Organizers: Ellen Baake (U. Greifswald), Don Dawson (Carleton U.), Warren Ewens (U. Pennsylvania), Bruce Rannala (U. Alberta)

Aug 14–19: **Statistical Science for Genome Biology**
Organizers: Jennifer Bryan (UBC), Sandrine Dudoit, Mark van der Laan (UC Berkeley)

Aug 21–26 : **Dynamics, Control and Computation in Biochemical Networks**
Organizers: Brian Ingalls (U. Waterloo), Leon Glass (McGill U.), John Reinitz (The University at Stony Brook), Eduardo Sontag (Rutgers U.), Erik Winfree (Caltech)

Aug 28–Sep 2: **Combinatorial Hopf Algebras**
Organizers: Frank Sottile (U. Massachusetts), Nantel Bergeron (York U.), Louis Billera (Cornell U.), S. van Willigenburg (UBC)

Sep 4–9: **Pluripotential Theory and its Applications**
Organizers: Len Bos, Alex Brudnyi (U. Calgary), Eric Bedford (U. Indiana), Al Taylor (U. Michigan)

Sep 11–16: **Commutative Algebra: Homological and Birational Theory**
Organizers: Ragnar-Olaf Buchweitz (U. Toronto), Paul Roberts (U. Utah), Bernd Ulrich (Purdue U.)

Sep 18–23: **Quantum Computation and Information Theory**
Organizers: John Watrous, Richard Cleve (U. Calgary), Umesh Vazirani (UC Berkeley)

Sep 25–30: **Interaction of Finite Dimensional Algebras with Other Areas of Mathematics**
Organizers: Vlastimil Dlab (Carleton U.), Claus Ringel (U. Bielefeld), Leonard Scott (U. Virginia)

Oct 2–7: **Self-Stabilizing Distributed Systems**
Organizers: Lisa Higham (U. Calgary), Anish Arora (Ohio State U.), Faith Fich (U. Toronto), Maurice Herlihy (Brown U.), Ted Herman (U. Iowa)

Oct 9–14: **Free Probability Theory**
Organizers: Alexandru Nica (U. Waterloo), Roland Speicher (Queen's U.), Dan Voiculescu (UC Berkeley)

Oct 16–21: **Braid Groups and Applications**
Organizers: Dale Rolfsen (UBC), Joan Birman (Columbia U.), Patrick Dehornoy (U. Caen), Roger Fenn (U. Sussex), Vaughan Jones (UC Berkeley)

Oct 23–28: **Mathematical Image Analysis and Processing**
Organizers: Mary Pugh (U. Toronto), Selim Esedoglu (UCLA), Sung Ha Kang (U. Kentucky), Jackie Shen (U. Minnesota)

Oct 30–Nov 4: **The Structure of Amenable Systems**
Organizers: George Elliott (U. Toronto), Andrew Dean (Lakehead U.), Thierry Giordano (U. Ottawa), Guihua Gong (U. Puerto Rico), Huaxin Lin, N. Christopher Phillips (U. Oregon)

Nov 6–11: **Functional Differential Equations** (1/2 workshop)
Organizers: Jianhong Wu (York U.), Hans-otto Walther (U. Giessen, Germany), John Mallet-paret (Brown U.)

Nov 6–11: **New Techniques in Lorentz Manifold** (1/2 workshop)
Organizers: Virginie Charette (U. Manitoba), Todd Drumm (Swarthmore College), William Goldman (U. Maryland)

Nov 13–18: **Explicit Methods in Number Theory**
Organizers: Peter Borwein (SFU), H. W. Lenstra (UC Berkeley), P. Stevenhagen (U. Leiden), H. Williams (U. Calgary)

Nov 20–25: **Diophantine Approximation and Analytic Number Theory**
Organizers: Michael Bennett, Greg Martin (UBC), John Friedlander (U. Toronto), Andrew Granville (U. Montreal), Cameron Stewart (U. Waterloo), Trevor Wooley (U. Michigan)

Nov 27–Dec 2: **Mathematical Models for Biological Invasions**
Organizers: Mark Lewis (U. Alberta), Mark Kot (U. Washington), Pauline van den Driessche (U. Victoria)

Dec 4–9: **Generalizations of de Bruijn Cycles and Gray Codes** (1/2 workshop)
Organizers: Brett Stevens (Carleton U.), Joe Buhler (Reed College), Persi Diaconis (Stanford), Fan Chung, Ronald Graham (UC San Diego), Frank Ruskey (U. Victoria)

Dec 4–9: **Numeracy and Beyond** (1/2 workshop)
Organizers: Klaus Hoechsmann (PIMS), Tony Gardiner (U. Birmingham), Yarom Sagher (U. Illinois), Guenter Toerner (U. Duisburg)

Dec 11–16: **Workshop on Resolution of Singularities, Factorization of Birational Mappings, and Toroidal Geometry**
Organizers: Kenji Matsuki, Jaroslaw Wlodarczyk (Purdue U.), Dan Abramovic (Boston U.), Edward Bierstone, Pierre Milman (U. Toronto), Steven Dale Cutkosky (U. Missouri)

2004 Programme for Focused Research Groups (FRG), Research in Teams (RIT), Summer Schools (SS) and 2-Day Workshops

Mar 13–27: **Cohomogeneity One Manifolds with Positive Sectional Curvature** (RIT)
Organizers: Wolfgang Ziller (U. Pennsylvania), Karsten Grove (U. Maryland), Burkhard Wilking (U. Muenster)

Mar 13–27: **Modular invariants and NIM-reps** (RIT)
Organizers: Terry Gannon, Matthias Gaberdiel (Kings College, London, UK)

Mar 18–20: **Human Infant Speech Perception and Language Acquisition** (2-day workshop)
Organizers: Janet Werker (UBC), Gary Marcus (NYU), Helen Neville (U. Oregon), Nuria Sebastian-Galles (U. Barcelona), Jacques Mehler (U. Trieste)

Mar 25–27: **Retreat on Mathematical Ecology and Evolution** (2-day workshop)
Organizers: Mark Lewis (U. Alberta), Ed McCauley (U. Calgary), Michael Doebeli (UBC), Thomas Hillen (U. Alberta), Mark Kot (U. Washington).

Apr 15–17: **PIMS PDF Meeting** (2-day workshop)
Organizer: Manfred Trummer (PIMS)

Apr 22–24: **Mathfair Workshop** (2-day workshop)
Organizers:Ted Lewis (U. Alberta), Andy Liu, Tom Holloway.

May 6–8: **Directions in Combinatorial Matrix Theory** (2-day workshop)
Organizers: Shaun Fallat, Steve Kirkland (U. Regina), Hadi Kharaghani (U. Lethbridge), Bryan Shader (U. Wyoming), Michael Tsatsomeros (Washington State U.), Pauline van den Driessche (U. Victoria)

May 13–15: **Decentralized Discrete Event Systems: Structure, Communication and Control** (2-day workshop)
Organizers: Peter Caines (McGill U.), Stephane Lafortune (U. Michigan), Laurie Ricker (Mount Allison U.), Karen Rudie (Queen's U.), John Thistle (U. Waterloo)

May 13–27: **Pi in the Sky Meeting** (RIT)
Organizer: Heather Jenkins (PIMS)

May 15–Jun 5: **Maximal Functions in Non-commutative Analysis** (RIT)
Organizers: Marius Junge (U. Illinois, Urbana-Champaign), Quanhua Xu (Besancon, France)

May 22–Jun 5: **Geometric Analysis of One and Several Complex Variables** (RIT)
Organizers: Steven Krantz (Washington U. St. Louis), Joseph Cima (U. North Carolina), Ian Graham (U. Toronto), Kang-Tae Kim (Pohang Institute, Korea)

Jun 3–5: **Adaptive Wavelet and Multiscale Methods for Partial Differential Equations** (2-day workshop)
Organizers: Tony Ware (U. Calgary), Manfred Trummer (SFU), Bin Han (U. Alberta), Michael Lamouroux (U. Calgary), Elena Braverman (U. Calgary)

Jun 3–10: **Geometry and Deformation Theory of Hyperbolic 3-manifolds** (RIT)
Organizers: Richard Canary (U. Michigan), Jeffrey Brock (Brown U./U. Texas), Kenneth Bromberg (U. Utah), Yair Minsky (Yale U.)

Jun 5–19: **Robust Analysis of Large Data Sets** (FRG)
Organizers: Ruben Zamar (UBC), Stefan Van Aelst (U. Ghent, Belgium)

Jul 10–24: **String Field Theory Camp** (FRG)
Organizers: Gordon Semenoff, Mark van Raamsdonk, Moshe Rozali (UBC)

Jul 15–17: **The Design and Analysis of Computer Experiments for Complex Systems** (2-day workshop)
Organizers: Derek Bingham (Canada Research Chair in Industrial Statistics), Randy Sitter (SFU).

Jul 24–Aug 7: **Stability and Computations for Stochastic Delay Differential Equations** (RIT)
Organizers: Rachel Kuske (UBC)

Jul 24–Aug 14: **Study of Affine Surfaces with Self-maps of Degree > 1 and the Jacobian Problem** (RIT)
Organizers: R.V. Gurjar (Tata Inst. of Fundamental Research, India), M. Miyanishi (Osaka U.), D.-Q. Zhang (National U.), Peter Russell (Mcgill U.)

Aug 5–7: **Combinatorial and Algorithmic Aspects of Networking and the Internet** (2-day workshop)
Organizers: Angele Hamel (Wilfrid Laurier U.), Alex Lopez-Ortiz (U. Waterloo), Ian Munro (U. Waterloo), Rajeev Motwani (Stanford U.), Andrei Broder (IBM T.J. Watson), Srinivasan Keshav (U.Waterloo)

Aug 7–21: **Competing Species and Predator-Prey Models and Measure-valued Diffusions** (RIT)
Organizer: Edwin Perkins (UBC)

Aug 12–14: **Linear Operators: Theory, Applications and Computations** (2-day workshop)
Organizers: Paul Binding (U. Calgary), Peter Lancaster (U. Calgary).

Aug 23–Sep 5: **Kinetic Models for Multiscale Problems** (FRG)
Organizers: Peter Markowich (Wolfgang Pauli Institute Vienna), Lorenzo Pareschi (U. Ferrara, Italy), Jin Shi (U. Wisconsin), Reinhard Illner (U. Victoria)

Sep 2–4: **Theoretical Physics Institute, University of Alberta Symposium** (2-day workshop)
Organizer: Frank Marsiglio (U. Alberta)

Sep 4–18: **Geometry and Analysis on Cauchy Riemann Manifolds** (RIT)
Organizers: John Bland (U. Toronto), Tom Duchamp (U. Washington), Charlie Epstein (U. Pennsylvania), Jack Lee (U. Washington)

Sep 18–25: **Research on Stochastic Models for the Web Graph and Other Scalefree Networks** (RIT)
Organizers: Jeannette Janssen (Dalhousie U.), Anthony Bonato (Wilfrid Laurier U.)

BIRS Calendar for 2005

2005 Programme for 5-day Workshops

Mar 12-17: **Dynamics, Probability, and Conformal Invariance:**
Organizers: P. Jones (Yale), M. Yampolsky (Toronto), I. Binder (Toronto), S. Rohde (Washington)

Mar 19-24 **Computational Fuel Cell Dynamics-III:**
Organizers: B. Wetton (UBC), K. Promislow (Michigan State), J. St. Pierre (Ballard)

Mar 26-31: **Representations of Kac-Moody Algebras and Combinatorics:**
Organizers: V. Chari (UC Riverside), G. Cliff (Alberta), P. Littelmann (Wuppertal), N. Reshetikhin (Berkeley)

Apr 2-7: **Workshop in Homotopical Localization and the Calculus of Functors**
Organizers: G. Peschke (Alberta), K. Bauer (Calgary), R. Cohen (Stanford), H. Sadofsky (Oregon)

Apr 9-14: **Complex Data Structures:**
Organizers: J. Stafford (Toronto), J. Berger (SAMSI), M. Thompson (Waterloo), N. Reid (Toronto)

Apr 16-21: **Numerical Relativity:**
Organizers: R. LeVeque (Washington), M. Choptuik (UBC), L. Lehner (Louisiana State), D. Arnold (Minnesota), E. Tadmor (Maryland)

Apr 23-28: **Applications of Torsors to Galois Cohomology and Lie Theory:**
Organizers: A. Pianzola (Alberta), V. Chernousov (Alberta), S. Kumar (North Carolina), D. Harari (ENS Paris)

Apr 30-May 05: **Micro- and Nano-fluidic Systems Descriptions:**
Organizers: J. Harrison (Alberta), J. Santiago (Stanford), K. Jensen (MIT)

May 7-12: **Aggregation and Disaggregation Characterization and Identification of Collective Demand:**
Organizers: P.A. Chiappori (Chicago), I. Ekeland (UBC)

May 14-19: **Densest Packings of Spheres:**
Organizers: K Bezdek (Calgary), H. Cohn (Microsoft Research), C. Radin (Texas, Austin)

May 21-26: **Moment Maps in Various Geometries**
Organizer: E. Lerman (Illinois UC), L. Jeffrey (Toronto), E. Meinrenken (Toronto), Y. Karshon (Toronto), T. Holm (Berkeley)

May 28-June 2: **Critical Scaling for Polymers and Percolation:**
Organizers: D. Brydges (UBC), J. Chayes (Microsoft Research), G. Slade (UBC)

Jun 4-9: **Mathematical Issues in Molecular Dynamics**
Organizers: P. Tupper (McGill), R. Skeel (Illinois UC)

Jun 11-16: **Geometric and Asymptotic Methods in Group Theory:**
Organizers: A. Rhemtulla (Alberta), M. Sapir (Vanderbilt), R. Grigorchuk (Texas A & M), A. Olshanskiy (Vanderbilt), D. Wise (McGill)

Jun 18-23: **Combinatorial Game Theory Workshop:**
Organizers: R. Nowakowski (Dalhousie), E. Berlekamp (Berkeley), M. Muller (Alberta), D. Wolf (Gustavus Adolphus)

July 9-14: **Rigidity, Dynamics, and Group Actions:**
Organizers: D. Fisher (Lehman, CUNY), R. Spatzier (Michigan), D. Witte Morris (Lethbridge)

July 16-21: **Mathematical Biology of the Cell: Cytoskeleton and Motility**
Organizers: L. Keshet (UBC), A Mogilner (UC Davis), P. Janmey (U Penn), E. Cytrynbaum (UBC)

July30-Aug 4: **Renaissance Banff: Mathematics, Music, Art, Culture:**
Organizers: R. Moody (Alberta), N. Ghoussoub (UBC), C. Rousseau (Montreal), R. Sarhangi (Towson), J. Morrow (Banff Centre)

Aug 20-25: **Mathematical Epidemiology:**
Organizers:P. van den Driessche (Victoria), H. Hethcote (Iowa), S. Levin (Princeton)

Aug 27-Sep 1: **Topology:**
Organizers: R. Stern (UC Irvine), I. Hambleton (McMaster), M. Hopkins (MIT), M. Kreck (Heidelberg)

Sep 3-8: **Workshop on Analytic and Algebraic Methods in Complex and CR Geometry:**
Organizers: J. Bland (Toronto), Y.T. Siu (Harvard), J. Kohn (Princeton), L. Lempert (Purdue), J. D'Angelo (Illinois UC)

Sep 10-15: **Interactions Between Noncommutative Algebra and Agebraic Geometry:**
Organizers: C. Ingalls (New Brunswick), M. Artin (MIT), Z. Reichstein (UBC), L. Small (UC, San Diego), J. Zhang (Washington)

Sep 17-22: **Order, Disorder, and Transport: Recent Advances in Schrodinger Operator Theory**
Organizers: P. Hislop (Kentucky), R. Froese (UBC), V. Jaksic (McGill), A. Klein (UC, Irvine)

Sep 24-29 **Time-frequency Analysis and Nonstationary Filtering:**
Organizers: G. Margrave (Calgary), H. Feichtinger (Vienna), K. Groechenig (Connecticut), M. Lamoureux (Calgary)

Oct 1-6: **Challenges in Linear and Polynomial Algebra in Symbolic Computation Software:**
Organizers: E. Kaltofen (North Carolina State), W. Decker (Saarlandes), K. Geddes (Waterloo), S. Watt (Western Ontario)

Oct 8-13: **Progress in Algebraic Geometry Inspired by Physics:**
Organizers: M. Thaddeus (Columbia), J. Bryan (UBC), R Vakil (Stanford)

Oct 15-22: **MITACS Week**
Organizers: MITACS

Oct 22-27: **Visco-plastic Fluids: from Theory to Application:**
Organizers: I. Frigaard (UBC), N. Balmforth (UC, Santa Cruz)

Oct 29-Nov 3: **Probabilistic Combinatorics: Recent Progress and New Frontiers:**
Organizers: B. Sudakov (Princeton), N. Alon (Tel Aviv), B. Redd (McGill), V. Vu (UC, San Diego)
Nov 1–6: **PIMS Hot Topic: Galaxy Formation; a Herculean Challenge**
Organizers: Arif Babul (U. Victoria), Julio Navarro (U. Victoria), Jeremiah Ostriker (Cambridge), Tom Quinn (U. Washington), Frank van den Bosch (U. Victoria), Neal Katz (U. Massachusetts)

Nov 5-10: **Number Theory Inspired by Cryptography:**
Organizers: D. Boyd (UBC), C. Pomerance (Dartmouth), I. Shparlinski (Macquarie), H. Williams (Calgary)

Nov 19-24: **MSRI Hot Topic**
Organizers: Jim Bryan (UBC), David Auckly (Kansas State U.)

Dec 3-8: **PIMS Hot Topic**
Organizers: Victor Batyrev (U. Tübingen), Shinobu Hosono (Tokyo), James D. Lewis (U. Alberta), Bong H. Lian (Brandeis), S.-T. Yau (Harvard), Noriko Yui (Queen's U.), Don Zagier (Max Planck Institut)

Dec 10-15: **Regulators II**
Organizers: J. Lewis (Alberta), V. Snaith (Southampton)

2005 Programme for Focused Research Groups (FRG), Research in Teams (RIT), Summer Schools (SS) and 2-Day Workshops

Mar 12-26: **Analysis, Computations and Experiments on Pinch-Off in Liquid Jets** (FRG)
Orgainzers: Huaxiong Huang (York University), Robert Muira (New Jersey Institute of Technology), Demetrius Papageorgiou (New Jersey Institute of Technology), Michael Siegel (New Jersey Institute of Technology)

Mar 17-19: **Second Northwest Functional Analysis Symposium** (2-Day Workshop)
Organizers: Doug Farenick (University of Regina), Marcelo Laca (University of Victoria), Michael Lamoureux (University of Calgary), Volker Runde (University of Alberta)

Apr 16- 30: **The Local Index Theorem in Noncommutative Geometry** (FRG)
Organizers: Nigel Higson (Pennsylvania State University), John Phillips (University of Victoria)

Apr 21-23: **Math Fair Workshops** (2-day Workshop)
Organizers: Ted Lewis (University of Alberta), Lee Grimard (University of Alberta)

Apr 30- May 14: **Speciality of Malcev Algebras** (RIT)
Organizers: Murray Bremnar (University of Saskatchewan), Irvin Hentzel (Iowa State University)

Apr 30 - May 14: **Random Matrices, Multi-Orthogonal Polynomials and Riemann-Hiebert Problems** (RIT)
Organizer: John Harnard (Concordia University)

May 12-14: **The Dark Side of Extra Dimensions** (2-day Workshop)
Organizers: Valeri Frolov (University Alberta), Lee Grimard (University of Alberta)

May 19-21: **Convex and Abstract Polytopes** (2-day Workshop)
Organizers: Ted Bisztriczky (University of Calgary), Egon Schulte (Northeastern University), Asis Weiss (York University)

May 21-Jun 4: **Affinizations of Extended Affine Lie Algebras** (RIT)
Organizers: Bruce Allison (University of Alberta), Stephan Berman (University of Saskatchewan), Artus Pianzola (University of Alberta)

May 28-Jun 11: **Influenza Dynamics Models and Data** (FRG)
Organizers: Jonathan Dushoff (Princeton University), David Eain (McMaster University), Joshua Plotkin (Harvard University)

Jun 9-11: **Meeting of Canadian CS Chairs-CACS/AIC** (2-day Workshop)
Organizers: Ken Barker (University of Calgary), Gord McCalla (University of Saskatchewan)

Jun 11-18: **Hyperplane Arrangements: Cohomology and Rational Homotopy** (FRG)
Organizers: Graham Denham (University of Western Ontario), Alexandru Suar (Northeastern University)

Jun 25-Jul 1: **PIMS Summer School: BREAD Summer School in Development Economics** (SS)
Organizers: Siwan Anderson (UBC), Esther Dufes (Massachusetts Institute of Technology), Sendhil Mullainathan (Harvard University)

Jun 28- Jul 9: **2005 Summer IMO Training Group** (SS)
Organizer: Bill Sands (University of Calgary)

Jul 14-16: **Cascade Topology Seminar Melling Spring 2005** (FRG)
Organizers: George Peschke (University of Alberta), Laura Scull (UBC)

Jul 16-30: **Topological Methods of Aperiodic Tilings** (FRG)
Organizers: Johannes Kellendonk (Universite Claude Bernard Lyon I), Ian Putnam (University of Victoria), Lorenzo Sadun (University of Texas)

July 21-23: **Connecting Women in Mathematics Across Canada II** (2-day Workshop)
Organizers: Gerda de Vries (University of Alberta), Malgorzata Dubiel (SFU), Rachel Kiske (UBC), Judith McDonald (Washington State University)

Aug 6-13: **Hyperbolic Geometry and Quasiconformal Mappings** (FRG)
Orgainzers: Petra Bonfert-Taylor (Wesleyan University), Martin Bridgeman (Boston College), Richard Canary (University of Michigan, Garan Martin (University of Auckland), Richard Schwartz (Univeristy of Maryland), Edward Taylor (Wesleyan University)

Aug 6-20: **Computing the Continuous Discretely: Integer Point Enumeration in Polyhedra S2 Convex and Discrete Geometry** (SS)
Organizers: Matthias Beck (San Franscio State University), Sinai Robins (Temple University), Hugo Rossi (Mathematical Sciences Research Insitute)

Aug 20-27: **Hamiltonian Systems with Symmetry** (RIT)
Organizer: George Patrick (University of Saskatchewan)

Aug 21- Sep 3: **Cohomogeneity Three Actions on Spheres** (RIT)
Organizers: Jill McGowan (Howard University), Catherine Searle (IMATE-UNAM Unidad Cuernavaca)

Aug 25- Sep 3: **Symmetries of External Conformal Mappings** (RIT)
Organizers: Oliver Roth (University of Wuerzburg), Eric Schippers (University of Manitoba)

Sep 15-17: **West Coast Operator Algebras Seminar 2005** (2-day Workshop)
Organizers: Anthony To-Ming Lau (University of Alberta), Volker Runde (University of Alberta)

Sep 29-Oct 1: **Alberta Postsecondary Curriculum Conference II** (2-day Workshop)
Organizer: Jack Macki (University of Alberta)

Oct 1-15: **Arthmetic Applications of Theta Functions** (RIT)
Orgainzers: Christopher Skinner (University of Michigan), Vinayak Vatsal (UBC)

Oct 13-16: **Pacific Rim Mathematical Forum** (2-day Workshop)
Organizers: Alejandro Adem (UBC), David Eisenbud (University of California, Berkeley), Ivar Ekeland (UBC)

Nov 3-5: **The Kneser-Poulsen Conjecture** (2-day Workshop)
Organizers: Karoly Bezack (University of Calgary), Robert Connelly (Cornell University)

Max Bell Building at the Banff Centre.

PIMS now has approximatiely 16 BIRS lectures available over the internet using on-demand streaming video and audio. See page 94 for a list.

BIRS website: **http://pims.math.ca/birs/**

I. COLLABORATIVE RESEARCH GROUPS

As part of its second phase of development, PIMS is embarking on a plan that will create and support collaborative multi-university teams of mathematical scientists. These Collaborative Research Groups (CRGs) will pool talent across universities to form world-class research groups that will generate and sustain the scientific programme of PIMS in the years to come.

The research programmes of these groups will be supported through a new PIMS programme that supports concentrated activities in 5–10 research areas each year. This programme, run on a competitive basis, will support multi-site activities of selected CRGs over a 1–2 year period of concentration.

Areas of Concentration: 2003–05

String Theory

Scientific Computing

Number Theory

Mathematical Ecology and Evolution

Dynamics and Related Topics

Areas of Concentration: 2004–06

Topology

Probability and Statistical Mechanics

Participants of the 2004 BIRS Workshop on New Horizons in String Cosmology. This workshop was an activity of the PIMS CRG on String Theory.

Probability and Statistical Mechanics CRG: Participants of the Summer School in Probability in the recently renovated PIMS conference room at UBC. The summer school took place from May 25–June 25, 2004.

What is a PIMS CRG?

The CRGs typically consist of researchers with a common research interest, and with a common desire to collaboratively develop some aspects of their research programmes. Groups may already 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 they will be able to 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 will build on already existing joint efforts and links between the researchers of Western Canada and the US Pacific Northwest thereby opening up a new era of scientific collaborations between the two countries. They will also will assume scientific leadership at the Banff Station and some will have the potential to lead industrial projects through the MITACS network.

The CRGs will create critical mass that will substantially enhance training programmes at all levels. The pooling of PIMS support with other sources and the joint planning of resource allocation will allow the CRGs to support a large number of PDFs and graduate students and will create 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 get plugged 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 consists of 10–15 Canadian and US researchers, are to be jointly coordinated by at least 3 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 Collaborative Research Groups (CRGs), in tandem with their national and international collaborators and visitors. Every year, the PIMS Scientific Review Panel will select, on a competitive basis, proposed POCs. The selected areas will be the focus of much of the institute's programme over a 1-2 year period of concentrated activities that will be delivered through the selected CRGs. At any given time, it is expected that 5–8 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
- 5-day workshops and other activities at BIRS
- 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 plan to 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, sign off on 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. Hence, 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. The proposed POC programme is evaluated by the PIMS Scientific Review Panel.

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 would 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, miniprogrammes, 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 longterm 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 PIMS, BIRS and the MITACS network.

• Create new research opportunities and enhance training: The periods of concentration will 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 will be new opportunities for PIMS graduate students and a larger audience for PIMS and visiting scientists. This will directly lead to a vigorous graduate student exchange programme.

• Support existing collaborative research groups and foster new groups: The periods of concentration will help to strengthen groups and give them a vehicle for long-range planning of research and advanced education activities. As well it will encourage and empower isolated groups or smaller ones at one university by bringing them into larger collaborative teams.

• Effectively facilitate Canada-US collaborations: The programme will effectively integrate the mathematical sciences community at the U. of Washington into the operations of the institute. It will allow the 12 groups of Canadian and US researchers that are currently organizing the PNW Seminars to develop further their collaborative activities, and allow other groups to launch these 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 will 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.

Areas of Concentration: 2003–05

String Theory

Recently, the concentration of research manpower in string theory and closely related fields in the communities associated with PIMS has reached a critical size so that it now has the potential to be a major player in the international research community. The purpose of this Period of Concentration in String Theory is to galvanize this group of researchers into a leading research unit. The members of this group already have a formal structure as a PIMS Collaborative Research Group. The Period of Concentration on String Theory gives this Group the resources to carry on a strong research programme at PIMS, to form a pan-Canadian network with the emerging groups at the University of Toronto and the Perimeter Institute and to communicate and collaborate with other string theory research groups worldwide.

The aim is to incubate significant original research in string theory and those areas of physics and mathematics that are influenced by string theory. The Period of Concentration will contribute by educating researchers on the latest developments in the field, encouraging and enhancing their research activity and providing a ready venue for dissemination of their results.

Scientifc Activities 2004–05

Frontiers of Mathematical Physics Summer School on Strings, Gravity & Cosmology August 3-13, 2004 PIMS, UBC

Please see page 37 for more information.

Participants of the 2004 Frontiers of Mathematical Physics Summer School putside the PIMS-UBC office.

Pacific Northwest String Seminar Jan 29–30, 2005, PIMS, UBC

Please see page 44 for more information.

BIRS Workshops

New Horizons in String Cosmology, 5–Day Workshop, June 12–17, 2004

String Field Theory Camp, Focused Research Group, July 10–25, 2004

Members of the CRG

PIMS PDFs of the CRG
UBC: Dominic Brecher, Kazuyuki Furuuchi, Kengo Maeda and Ehud Schreiber

Faculty of the CRG
Leaders: Gordon Semenoff (UBC), Eric Woolgar (U. Alberta)
SFU: K. Viswanathan
U. Alberta: B. Campbell, V. Frolov, T. Gannon, D. Page
UBC: K. Behrend, J. Bryan, M. Choptuik, M. Van Raamsdonk, M. Rozali, K. Schleich, W. Unruh, D. Witt
U. Lethbridge: M. Walton
U. Toronto: A. Peet
U. Washington: A. Karch
Perimeter Institute: R. Myers, L. Smolin
APCTP: T. Lee

The String Theory CRG webpage is at **www.pims.math.ca/Collaborative_Research_Groups/PIMS_CRG_on_String_Theory:_2003-2005.**

Gordon Semenoff (UBC), and Eric Woolgar (UA) co-leaders of the CRG on String Theory.

Scientific Computing

The major goal of this period of concentration is to develop the group's common research programmes and to promote research in scientific computing and increase related interdisciplinary collaboration within the region. In addition, this period of increased activity in scientific computing provides a focus to kickstart and solidly establish SFU's Centre for Scientific Computing (CSC). The majority of the activity of this concentration period will take place at the PIMS sites at SFU, UW and UBC and at BIRS. The organizers are committed to organizing a number of activities which bring in the other PIMS sites as well.

A special feature of this period of concentration is the promotion of a multidisciplinary approach to the subject and the inclusion of important research topics such as the earth and atmospheric sciences.

Scientific Activities 2004–05

PIMS-MITACS Centre for Scientific Computing Seminar

For more information, including the list of lectures, see page 52.

Otmar Scherzer (left) from the University of Innsbruck, and Chris Budd (right) from the University of Bath.

Otmar Scherzer (University of Innsbruck), PIMS Distinguished Chair, UBC

Please see for more information please see page 38

Chris Budd (University of Bath), PIMS Distinguished Chair, SFU

Please see for more information please see page 38

BIRS Workshops

Mathematical Foundations of Scientific Visualization, Computer Graphics and Massive Data Exploration, 5–Day Workshop, May 22–27, 2004

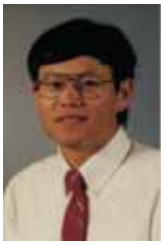
Participants of the BIRS Workshop on Mathematical Foundations of Scientific Visualization, Computer Graphics and Massive Data Exploration.

ABCW Workshop in Numerical Analysis, 2–Day Workshop, September 30–October 2, 2004

Members of the CRG

PIMS PDFs of the CRG:
SFU: Jian-Jun Xu
UBC: Jianying Zhang

Faculty of the CRG:
Coordinator: Steve Ruuth (SFU)
CRG Leaders: Elana Braverman (U. Calgary), Chen Greif (UBC), Randy Leveque (U. Washington), Yanpin Lin (U. Alberta), Steve Ruuth (SFU), Manfred Trummer (SFU)
SFU: R. Choksi, M.C. Kropinski, T. Möller, D. Muraki, K. Promislow, B. Russell, S. Ruuth, L. Trajkovic, M. Trummer, J. Verner, R. Zahar.



CRG on Scientifc Computing group leaders (clockwise from top left)*:* ***Steve Ruuth*** *(CRG Coordinator, SFU),* ***Manfred Trummer*** *(SFU),* ***Chen Grief*** *(UBC),* ***Randy Leveque*** *(U. Washington),* ***Elena Braverman*** *(U. Calgary) and* ***Yanpin Lin*** *(U. Alberta).*

U. Alberta: Y. Lin, J. Macki, P. Minev, Y.S. Wong
UBC: U. Ascher, O. Dorn, S. Dunbar, I. Frigaard, A. Peirce, B. Seymour, B. Shizgal, J. Varah, M. Ward, B. Wetton, M. Yedlin
U. Calgary: T. Ware, R. Westbrook
U. Victoria: P. van den Driessche, D. Olesky
U. Washington: L. Adams, C. Bretherton, J. Burke, D. Durran, A. Greenbaum, G. Hakim, N. Kutz, R. LeVeque, R. O'Malley, P. Schmid

Ballard Corp: R. Bradean, J. Kenna
Boeing Corp: M. Epton, S. Filipowski, J. Lewis
Quadrus Financial Technologies: S. Reddy

The Scientific Computing CRG webpage is **www.pims.math.ca/Collaborative_Research_Groups/PIMS_CRG_on_Scientific_Computing:_2003-2005/**.

Number Theory

Number theory is one of the oldest, deepest and most vibrant branches of modern mathematics. It centrally incorporates some of the most sophisticated and profound mathematical ideas that have been developed (witness the recent proof of Fermat's Last Theorem) and yet remains broadly useful in many areas of pure and applied mathematics. Indeed, it is remarkable how often number theory comes to bear both in other areas of mathematics and in applications. A notable recent example is cryptography and internet security whose protocols are based on number theoretic problems.

Number theory is particularly strong in Canada with the PIMS Number Theory Group featuring prominently. The PIMS Number Theory Group is large and well distributed in the PIMS Universities. It has a number of prominent senior world-class researchers leading a group of richly talented young mathematicians. The recent influx of new number theorists into several PIMS universities has created an exciting working group.

All areas of Number Theory will be dealt with in this concentration period, including computational and arithmetic aspects.

Scientific Activities 2004–05

Sergei Konyagin, PIMS Distinguished Chair, UBC

Please see page 38 for a full report.

Bjorn Poonen, PIMS Distinguished Chair, SFU

Please see page 38 for a full report.

PIMS Distinguished Chair Bjorn Poonen from UC, Berkeley spoke at the Computational Arithmetic Geometry Workshop at PIMS SFU, July 5–9, 2004.

PIMS Pacific Northwest Number Theory Seminar April 17–18, 2004, Corvalis Oregon

Please see page 43 for a full report.

Workshop Computational Arithmetic Geometry July 5 - 9, 2004, PIMS-SFU.

Please see page 58 for a full report.

SFU/UBC Number Theory Seminar ongoing at SFU/UBC

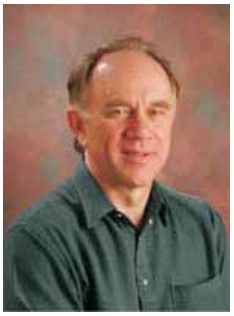
Please see page 47 for a full report.

BIRS Workshops

Explicit Methods in Number Theory, 5–Day Workshop, November 13–18, 2004

Number Theorists Weekend , 2–Day Workshop, November 18 - 20, 2004 at BIRS

Diophantine Approximation and Analytic Number Theory, 5–Day Workshop, November 20–25, 2004



David Boyd (UBC), co-leader of the CRG on Number Theory.

Peter Borwein (SFU), co-leader of the CRG on Number Theory.

Members of the CRG

PIMS PDFs of the CRG:
SFU: Ron Ferguson, William Galway, Alexa van der Waall
UBC: Ben Green, Friedrich Littman, Christopher Rowe
Faculty of the CRG:
Group Leaders: Peter Borwein (SFU), David Boyd (UBC)
SFU: I. Chen, S. Choi, P. Lisonek
U. Alberta: J. D. Lewis
U. Calgary: R. Guy, J. P. Jones, R. Mollin, R. Scheidler, H. Williams
UBC: M. Bennett, W. Casselman, R. Gupta, I. Laba, G. Martin, N. Vatsal
U. Washington: R. Greenberg, A. Iovita, N. Koblitz, B. Solomyak
Other institutions: A. Akbary (U. Lethbridge), E. Dobrowolski (College of New Caledonia), M. Klassen (DigiPen Inst. Tech.), K. Lauter (Microsoft)

The Number Theory webpage is at **www.pims.math.ca/Collaborative_Research_Groups/PIMS_CRG_on_Number_Theory:_2003-2005/**.

Mathematical Ecology and Evolution

As the current revolution in biological information progresses, there is a well recognized need for new quantitative approaches and methods to solve problems in ecology. One challenge is to model complex ecological systems—systems which depend upon a myriad of inputs, but often with incomplete details regarding the inputs.

The primary goal of this period of concentration is to develop and strengthen the synergistic interactions between mathematics and ecology in PIMS universities.

Areas of mathematical ecology research at PIMS universities include: nonlinear population dynamics, spatially structured populations, adaptive dynamics, model selection and validation and inverse methods, stochastic models for populations, and scaling laws—from individuals to populations.

Participants of the International Conference Differential Equations and Applications in Mathematical Biology which was held in Nanaimo.

Scientific Activities 2004–05

3rd Annual PIMS Mathematical Biology Summer Workshop for Undergraduates University of Alberta, May 4–14, 2004

Please see page 73 for a full report.

International Conference Differential Equations and Applications in Mathematical Biology, July 18-23, 2004, Nanaimo, Vancouver Island, BC

Please see page 59 for a full report.

Roger Nisbet, PIMS Distinguished Chair, U. Calgary, U. Alberta

Please see page 38 for a full report.

Mathematical Biology Seminar at U. Alberta

Please see page 51 for a full report.

BIRS Workshops

Retreat on Mathematical Ecology and Evolution, 2–day Workshop, March 18–20, 2004

Mathematical Models for Biological Invasions, 5-day Workshop, November 27–December 2, 2004

Members of the CRG

PIMS PDFs of the CRG:
U. Alberta & U. Calgary: Frithjof Lutscher
U. Alberta & U. Victoria: Joanna Renclawowicz
UBC: Mario Pineda-Krch

Faculty of the CRG:
Coordinator: Thomas Hillen (U. Alberta)
Co-organizers: Michael Doebeli (UBC), Mark Lewis (U. Alberta), Edward McCauley (U. Calgary)
SFU: E. Palsson, B. Roitberg
U. Alberta: M. Boyce, H. Freedman, S. Lele, M. Li, J. Roland, J. So
UBC: F. Brauer, L. Keshet, D. Schluter
U. Calgary: S. Richards
U. Victoria: P. van den Driessche
U. Washington: J. Anderson, C. Bergstrom, D. Grunbaum, R. Hilborne, M. Kot

The webpage for this CRG is at **www.pims.math.ca/Collaborative_Research_Groups/PIMS_CRG_on_Mathematical_Ecology_and_Evolution:_2003-2005/**.

Clockwise from top left: Co-organizers of the Math Ecology and Evolution CRG Michael Doebeli (UBC), Mark Lewis (U. Alberta), Edward McCauley (U. Calgary), and CRG Co-ordinator Thomas Hillen

Dynamics and Related Topics

The study of dynamical systems has had a long and distinguished history in mathematics. This study has ranged from applications involving differential equations and information theory, to more theoretical work focusing on systems with topological or algebraic structure. In the past few decades this field has grown dramatically, and completely new directions have opened up.

Due to the diversity of the researchers in this CRG a wide range of topics will be covered including operator algebras, the dynamics of biological systems, and aperiodic order theory.

Scientific Activities 2004–05

Daniel Rudolph, PIMS Distinguished Chair, University of Victoria

Please see page 38 for a full report.

BIRS Workshop

Aperiodic Order: Dynamical Systems, Combinatorics, and Operators, 5-Day Workshop, May 29–June 3, 2004

Participants of the BIRS Workshop on Aperiodic Order: Dynamical Systems, Combinatorics, and Operators, May 29–June 3, 2004.

Members of the CRG

Faculty of the CRG:
Group Leaders: Douglas Lind (U. Washington), Ian Putnam (U. Victoria)
U. Alberta: A. Lau, R. Moody, V. Runde, A. Weiss
U. Calgary: B. Brenken, M. Lamoureux, I. Nikolaev
U. Victoria: C. Bose, R. Edwards, M. Laca, J. Phillips
U. Washington: M. Einsiedler, C. Hoffman, D. Lind, S. Rohde, B. Solomyak, S. Tuncel
Visitors and other contributors: M. Boyle (Maryland), C. Denninger (Muenster), W. Parry (Warwick), D. Rudolph (Maryland), K. Schmidt (Vienna)

The Dynamics & Related Topics webpage is at **www.pims.math.ca/Collaborative_Research_Groups/PIMS_CRG_on_Dynamics_and_Related_Topics:_2003-2005/**.

Ian Putnam (U. Victoria) and Douglas Lind (U. Washington), co-leaders of the CRG on Dynamics and Related Topics.

Areas of Concentration: 2004–06

Topology and Knot Theory

The PIMS community has an active group of researchers in topology and related fields. Their research may be roughly divided into two major themes: geometric and algebraic. Among the geometric issues being studied by PIMS topologists are the classification of manifolds (particularly in dimension 3 and 4), group actions on Riemann surfaces, knot theory and its applications, and relating 3-manifold topology to relativity theory. A sample of the contributions in algebraic topology are: application of algebraic topology to robotics, developing equivariant minimal models in homotopy theory, applying subtle algebraic properties of projective spaces and bundles to solve classical problems in quadratic forms and combinatorics. Because of their geographic separation and diversity of interests, this community of scientists is particularly well-served by forming a collaborative research group.

Scientific Activities 2004–05

MSRI-PIMS Summer Graduate Programme: Knots and 3-Manifolds, UBC, July 7-20, 2004

Please see page 36 for a full report.

Knots in Vancouver: Workshop in Knot Theory and 3-Manifolds, UBC, July 19-23, 2004

Please see page 61 for a full report.

Knots in Vancouver.

Roger Fenn, PIMS Distinguished Chair, UBC

Please see page 38 for a full report.

Elena Kudryavtseva, PIMS Visiting Research Fellow, University of Calgary, September 2004

BIRS Workshops

Topology of Manifolds and Homotopy Theory, 5–day Workshop, March 20–25, 2004

Knots and their Manifold Stories, 5–day Workshop, May 8–13, 2004

Braid Groups and Applications, 5–day Workshop, October 16–21, 2004

Members of the CRG

Faculty of the CRG:
Group Leaders: George Peschke (U. Alberta), Dale Rolfsen (UBC), Laura Scull (Primary Contact, UBC), Peter Zvengrowski (U. Calgary)
U. Alberta: J. Timourian
UBC: J. Bryan, K. Lam, D. Sjerve
U. Calgary: K. Varadarajan
U. Washington: E. Babson, E. Devinatz, M. Freedman, S. Mitchell, J. Palmieri, J. Segal

The Topolgy & Knot Theory CRG webpage is at **www.pims.math.ca/Collaborative_Research_Groups/PIMS_CRG_on_Topology:_2004-2006/**.

Clockwise from top left: George Peschke (U. Alberta), Dale Rolfsen (UBC), Laura Scull (UBC), and Peter Zvengrowski (U. Calgary), the group leaders of the CRG on Topology and Knot Theory.

Probability and Statistical Mechanics

Much of the original motivation for the study of spatially interactive stochastic systems came from stochastic models in statistical physics. An intensive area of recent research centers around the idea that complex local dynamics can lead to a small number of well-understood continuum models upon space-time rescaling. When the underlying system is at or near criticality the limit invariably seems to be closely related to super-Brownian motion.

Other local interactions arising in models for competing species, predator-prey systems or symbiotic branching lead to more complex stochastic models which behave locally like superprocesses but with branching, migration and drift coefficients which depend on the current state of the system. Two challenging and related topics are therefore:
I. The development of a general theory of interactive superprocesses and in particular methods to characterize these processes and study their properties.
II. The use of such models in mathematical ecology and evolution.

Scientific Activities 2004–05

Summer School in Probability, May 25–June 25, 2004, UBC

Please see page for 74 for a full report.

Seminar on Stochastic Processes, May 20–2, 2004, UBC

Please see page 57 for a full report.

Analysis, Probability, and Logic: a Conference in Honor of Edward Nelson, June 17–18, 2004, UBC

Please see page 57 for a full report.

Robert Wolpert (Duke, former student of Ed Nelson), Gerald Folland (Washington), Greg Lawler (Cornell) and Ed Nelson (Princeton) outside PIMS-UBC. They were part of "Analysis, Probability, and Logic: A Conference in Honour of Edward Nelson".

PIMS Probability Seminar Lecture Series on the *Sherrington-Kirkpatrick Spin Glass* by Erwin Bolthausen, (Institut fur Mathematik, U. Zürich), June 21–July 2, 2004, UBC

Pacific Northwest Probability Seminar, October 23, 2004, U. Washington

Please see page 44 for a full report.

PIMS Probability Seminars, UBC

Please see page 48 for a full report.

Richard Bass, PIMS Distinguished Chair, UBC

Please see page 38 for a full report.

Yaozhong Hu, PIMS Distinguished Chair, University of Alberta

Please see page 38 for a full report.

BIRS Workshops

Analytic and Geometric Aspects of Stochastic Processes 5-Day Workshop, April 10–15, 2004

Stability and Computations for Stochastic Differential Delay Equations, Research in Teams, July 24–August 7, 2004,
Participants: Salah Mohammed (Southern Illinois University), Evelyn Buckwar (Humboldt University), Tony Shardlow (Manchester), Rachel Kuske (UBC)

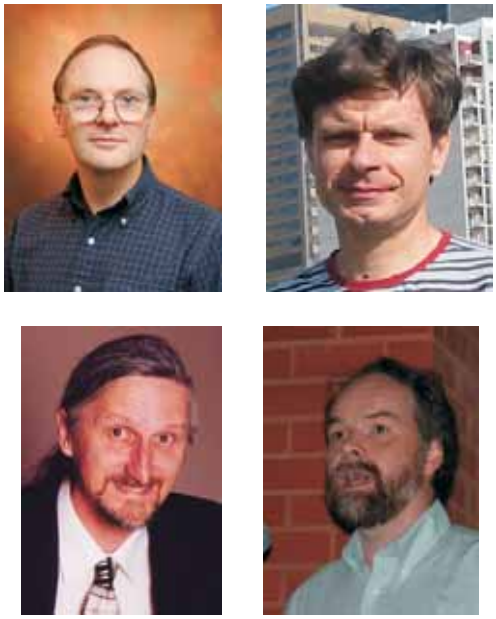
Competing Species and Predator-Prey Stochastic Models, Research in Teams, August 2004
Participants: Rick Durrett (Cornell U.), Leonid Mytnik (Technion), Ed Perkins (UBC)

Members of the CRG

PIMS PDFs of the CRG
UBC: Omer Angel

Faculty of the CRG:
Group Leaders: David Brydges (UBC), Chris Burdzy (U. Washington), Ed Perkins (UBC), Byron Schmuland (U. Alberta)
U. Alberta: M. Kouritzin
UBC: M. Barlow, J. Feldman, A. Holroyd, V. Limic, G. Slade, J. Walsh
U. Saskatchewan: C. Soteros, R. Srinivasan
U. Washington: Z.-Q. Chen, B. Erickson, C. Hoffman, L. Korf, S. Rohde
Microsoft Research: C. Borgs, J. Chayes, O. Schramm, D. Wilson
Other Institutions: D. Dawson (McGill), R. van der Hofstad (Eindhoven)

The Probability & Statistical Mechanics CRG webpage is at **www.pims.math.ca/Collaborative_Research_Groups/PIMS_CRG_on_Probability_and_Statistical_Mechanics:_2004-2006/**.



Clockwise from top left: David Brydges (UBC), Chris Burdzy (U. Washington), Ed Perkins (UBC), and Byron Schmuland (U. Alberta), group leaders of the CRG on Probability and Statistical Mechanics.

II. CORE SCIENTIFIC PROGRAMMES

PIMS PDF Ben Green (Trinity College, Cambridge), and Terence Tao (University of California, Los Angeles) made a new discovery concerning prime numbers.

Roger Nisbet (University of California, Santa Barbara), PIMS Distinguished Chair at the University of Alberta and the University of Calgary.

Participants of the MSRI-PIMS Summer Graduate Programme: Knots and 3-manifolds, July 7-20, 2004 at PIMS, UBC.

PIMS Mini-Programmes and Summer Schools

PIMS Mini-programmes are recurring or one-time workshops which are shorter and more intensive than thematic programmes, with a focus on fewer formal lectures and more opportunities for active collaborative work between participants than a conference.

Summer schools have a similar focus to mini-programmes but are aimed at graduate students and/or senior undergraduate students. Often university departments will agree to give credit to students for attending PIMS summer schools.

Most workshops of these forms take place over two or more weeks. Mini-programmes and Summer Schools may take place as part of the CRG Periods of Concentration or be conducted on separate topics.

MSRI-PIMS Summer Graduate Programme: Knots and 3-Manifolds

July 7– 20, 2004, University of British Columbia, Vancouver

Organizers: Steven Boyer (University of Quebec at Montreal), Roger Fenn (University of Sussex), Dale Rolfsen, Chair (UBC), Denis Sjerve (UBC)

This programme was co-sponsored by MSRI and PIMS and it was attended by graduate students nominated by MSRI's Academic Sponsors

The mathematical theory of knots has become one of the most active areas of mathematics in the last few decades. Two important reasons for this are that many fields of mathematics (and physics) converge in the study of knots, and secondly there are applications to the study of manifolds as well as fields such as stereochemistry and molecular biology.

This course began with an introduction to the subject, covering classical subjects such as the knot group, Seifert surfaces, Dehn surgery, branched coverings, Alexander polynomial as well as more recent work such as knot polynomials, skein theory, etc. The second week was devoted to more specialized subjects such as hyperbolic geometry in knot theory, quantum invariants, Vassiliev theory, representation theory and the Casson invariant. The course was taught by teams, each emphasizing a particular aspect of knot and 3-manifold theory:

Roger Fenn (University of Sussex) and **Dale Rolfsen** (UBC): Basic theory of knots and 3-manifolds, knot group, Alexander invariant, Fox calculus. Dehn surgery, calculus, cobordism, signature. Fibred knots, and 3-manifolds, foliations and similar structures

Lou Kauffman (University of Illinois, Chicago) and **Sofia Lambropoulou** (National Technical University): Knot Theory from a Combinatorial point of view. Introduction to Virtual Knot Theory and the Jones polynomial via the Bracket polynomial. Rational Tangles and Rational Knots, Tai Conjecture and its uses including tangle fractions and the classification of rational tangles. Classifying Rational Knots and Links. Converting knots to braids and the Markov Theorem to produce "quantum link invariants". Matrix state sum models for link invariants, a hint about Hopf algebras and quantum groups. Vassiliev invariants, Lie Algebras and Feynman Integrals.

Sergei Matveev (Chelyabinsk State University) and **Jozef Przytycki** (The George Washington University): Theory of normal curves. Normal surfaces and algorithmic recognition of the unknot. Algorithmic recognition of the 3-sphere. Khovanov homology and skein modules.

Colin Adams (Williams College) and **Nathan Dunfield** (Caltech): Hyperbolic geometry related to knots and 3-manifolds

Minicourses by **Vladimir Turaev** (Director of Research National Center of Scientific Research (CNRS), Strasbourg,

France): *Virtual strings;* **De Witt Sumners** (Florida State University): *DNA Topology, Experiments and Analysis;* **Susan Williams** (University of Southern Alabama), **Dan Silver** (Yale University): *Applications of Symbolic and Algebraic Dynamics to Knot Theory.*

There were also guest lectures by **Dylan Thurston** (Columbia University), **Rob Kirby** (University of California, Berkeley), and **Steven Bigelow** (University of California, Santa Barbara). In addition, the following assistants facilitated discussion at the problem sessions and helped in other respects: **Gabriel Indurskis** (University of Quebec, at Montreal), **Matthew Weston** (University of Sussex), and **Mercedes Jordan-Santana**. The course was followed by a research workshop at PIMS, July 19-23, on knot theory and 3-manifolds.

Frontiers of Mathematical Physics: Summer School on Strings, Gravity & Cosmology

August 3–13, 2004, University of British Columbia

Organizers: Taejin Lee (Asia Pacific Centre for Theoretical Physics), Moshe Rozali (University of British Columbia), Gordon W. Semenoff (University of British Columbia), Mark van Raamsdonk (University of British Columbia), Don Witt (University of British Columbia).

This summer school program is the ninth in the Frontiers in Mathematical Physics Series. It was jointly sponsored by PIMS, the Asia Pacific Centre for Theoretical Physics, the Perimeter Institute for Theoretical, the Department of Physics and the Faculty of Science of the University of British Columbia. The summer school was intended to educate graduate students and young researchers on current developments in string theory, and its interface with gravity and cosmology.

The 2004 speakers were:

Ian Affleck (University of British Columbia): *Conformal Field Theory and Condensed Matter*
Robert Brandenburger (Brown University): *Topics in String Cosmology*
Clifford Johnson (University of Southern California and Durham University): *D-branes*
Shamit Kachru (Stanford University): *String Compactifications*
Rob Leigh (University of Illinois at Urbana-Champaign): *SUSY*
Emil Martinec (University of Chicago): *Matrix Models and 2d String Theory*
Leonardo Rastelli (Princeton University): *AdS/CFT*
Simon Ross (Durham University): *Black Hole Thermodynamics*
Volker Schomerus (Saclay): *Strings and Branes in AdD_3*
Washington Taylor (MIT): *Nonperturbative Formulations of String Theory*

Participants of the 2004 Frontiers of Mathematical Physics Summer School outside the PIMS-UBC office.

PIMS Distinguished Chairs

PIMS has established a programme of Distinguished Chairs, which serves to host eminent researchers in the mathematical sciences for extended visits at the PIMS sites. The researchers will have the opportunity to collaborate with colleagues at the PIMS universities and to give a series of lectures on their work.

PIMS Distinguished Chairs for 2004/05

Roger A. Fenn (University of Sussex)
Site: Topology CRG at University of British Columbia
April 2004

Sergei Konyagin (Moscow State University)
Site: Number Theory CRG at University of British Columbia
April–May 2004

Bjorn Poonen (University of California, Berkeley)
Site: Number Theory CRG at Simon Fraser University
June–July 2004

Chris Budd (University of Bath)
Site: Scientific Computing CRG at Simon Fraser University
July 2004

Yaozhong Hu (University of Kansas)
Site: Probability CRG at University of Alberta
August 2004– August 2005

Richard Bass (University of Connecticut)
Site: Probability CRG at UBC
September 2004- August 2005

Andras Hajnal (Rutgers University)
Site: University of Calgary
September–October 2004

Roger Nisbet (University of California, Santa Barbara)
Site Math Ecology CRG at University of Alberta, and University of Calgary
September–October 2004

Otmar Scherzer (University of Innsbruck, Austria)
Site: Scientific Computing CRG at University of British Columbia
July–September 2004

Dan Rudolph (University of Maryland)
Site: Dynamics CRG at University of Victoria
October 2004

Roger A. Fenn.

Dr. Roger A. Fenn of the University of Sussex was the PIMS Distinguished Chair in Topology at the University of British Columbia during April 2004. He delivered a series of four lectures entitled *Turning Knots into Algebra*. Dr. Fenn's research interests lie in Low dimensional topology, knots links and braids, generalized braids and associated algebra. Dr. Fenn received his Ph.D. from the University of London. Currently, Dr. Fenn is researching one of the most exciting recent developments in the theory of braids , the discovery by P. Dehornoy of a linear ordering.

Professor Sergei Konyagin of the Moscow State University was the PIMS Distinguished Chair in Number Theory at the University of British Columbia during April and May of 2004. Winner of the Salem Prize in 1990, Professor Konyagin has made numerous and significant contributions to the field of number theory and harmonic analysis. During his stay with PIMS, Professor Konyagin delivered three lectures. For more information and notes from the lecture please see: **www.pims.math.ca/science/2004/distchair/konyagin**

Sergei Konyagin.

Dr. Bjorn Poonen, of the University of California at Berkeley, was the PIMS Distinguished Chair in Number Theory at Simon Fraser University during June and July of 2004. He received his Ph.D. degree from the University of California at Berkeley, where he now holds the title of Professor of Mathematics. His other affiliations have included the Mathematical Sciences Research Institute, Princeton University, the Isaac Newton Institute, and the Universite de Paris-Sud. His main research is in number theory and algebraic geometry, but he has published also in combinatorics and probability. In addition, Dr. Poonen has been a winner of USAMO, a medallist of the International Mathematical Olympiad, and a four-time winner of the Putnam competition.

Bjorn Poonen.

Chris Budd.

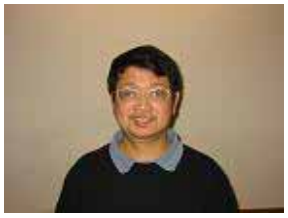
Chris Budd of the University of Bath was the PIMS Distinguished Chair in Mathematical Ecology during the summer of 2004. He is a professor of Applied Mathematics at the University of Bath and the Chair of Mathematics at the Royal Institution of Great Britain. His research interests are in the theory, application and computation of nonlinear problems with special interest in problems which arise in industry. Much of his recent work has been on the development of accurate adaptive methods of solving nonlinear parabolic equations based upon the application of ideas from the theory of Lie groups, which inherit the dynamics and associated conservation laws of the underlying partial differential equations. Dr. Budd gave two lectures during his time as a Distinguished Chair. Both of his talks were delivered at Simon Fraser University. His talks were entitled:

Introduction to multi-scale problems in heterogeneous and homogeneous materials

Origin, significance and application of polynomial scaling laws.

For more information please see **www.pims.math.ca/science/2004/distchair/budd/**

Yaozhong Hu was a PIMS Distinguished Chair in Probability and Statistical Mechanics CRG at the University of Alberta from August 2004 to August 2005. Dr. Hu is an associate professor at the University of Kansas. His research interests are in probability, statistics, and math finance. Dr. Hu received his Ph.D. from the Department of Mathematics and Computer Science at Louis Pastuer University in Strasbourg, France. He is also a member of the University of Kansas' Stochastic Adaptive Control Group, which holds weekly lectures on topics concerned with probability and statistics.



Yaozhong Hu.

Richard Bass.

Richard Bass of the University of Connecticut was a PIMS Distinguished Chair in Probability and Statistical Mechanics CRG at UBC from September 2004 to August 2005. Dr. Bass received his Ph.D. from the University of California at Berkeley and is now a full professor in the University of Connecticut's mathematics department. In 2001 he was awarded the University of Connecticut's Chancellor's Award for Research Excellence, and in 1989 he was named an elected fellow of the Institute of Mathematical Statistics. Dr. Bass is also the associated editor of the journals *Annals of Probability* and *Stochastic Processes and Their Applications*.

Dr. Andras Hajnal of Rutgers University was the PIMS Distinguished Chair at the University of Calgary during September and October of 2004. He has been a faculty member of Rutgers University's mathematical department since 1995, coming to the department after serving a year as the Director of the Center for Discrete Mathematics and Theoretical Computer Science (DIMACS). A recipient of numerous awards, including the Officer's Cross of Decoration of the Republic of Hungary (1992), Dr. Hajnal has also served as the President of the Bolyai Society (1990-1994). He has been a member of the

editorial boards of *Combinatorica*, *Discrete Mathematics*, *Periodica*, and *Annals of Combinatorics*. During his time at the University of Calgary he delivered a talk entitled, *On the Chromatic Number of Graphs and Set Systems*.

Andras Hajnal.

Roger Nisbet.

Dr. Roger Nisbet of the University of California at Santa Barbara was the PIMS Distinguished Chair at both the University of Alberta and the University of Calgary during September and October of 2004. Dr. Nisbet received his PhD in Theoretical Physics from St. Andrew's University in 1971. His research interests are in theoretical ecology, population dynamics, and energy budget theory. Currently, he is a professor in the Department of Biological Sciences and Department of Ecology at UC Santa Barbara. Dr. Nisbet has also authored three books on the topics of ecology and biology. The titles of these books are: *Modelling Fluctuating Populations* (1982), *Ecological Dynamics* (1998), and *Consumer Resource Dynamics* (2003).

Dr. Otmar Scherzer of the University of Innsbruck was a PIMS Distinguished Chair at the University of British Columbia from July to September 2004. Dr. Scherzer received his PhD in mathematics from the Universitat Linz in 1990. His research interests are focused on inverse problems, regularization, image processing, and PDEs. Currently, Dr. Scherzer is a professor in the Department of Computer Science at the University of Innsbruck and is a member of the editorial board of the journal *Inverse Problems*.

Otmar Scherzer.

Dan Rudolph was a PIMS Distinguished Chair at the University of Victoria during October 2004. Dr. Rudoplh is a professor of mathematics at the University of Maryland. His area of research is measurable dynamics, which is usually called "ergodic theory". This is a central branch of dynamical systems with broad connections to smooth and low dimensional dynamics, symbolic dynamics, and topological dynamics. While at the University of Victoria, Dr. Rudolph gave a one lecture in three pars. His lecture was entitled *Entropy and Orbit Equivalence in Measure Preserving Dynamics*. The purpose of these lectures was to present a link between two fundamental ideas in the study of measure preserving transformation of a probability space. The study of such transformations, or groups of such transformations, is central to ergodic theory and as dynamical systems often possess natural invariant measures, it is central to dynamics generally. The complete abstract of this lecture is available on the web at **www.pims.math.ca/science/2004/distchair/rudolph**. These lectures were also filmed and the video links, and lecture notes, are also available on the PIMS website.

Dan Rudolph.

PIMS Postdoctoral Fellows

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.

PIMS PDFs for 2004/05

The PIMS PDF selection in the 2004/05 competition was made by Kieka Mynhardt (UVic), Chen Greif (UBC), Derek Bingham (SFU), Sudarshan Kumar Sehgal (UA), Michael Lamoureux (UC).

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

Wael Bahsoun: *Measurable Dynamics*
Supervised by Chris Bose (University of Victoria)

Boaz Ben-Moshe: *Computational Geometry*
Supervised by Binay K. Bhattacharya (Simon Fraser University)

Shlomo Hoory: *Expander Graphs*
Supervised by Joel Friedman (UBC)

Hosne Ara Jasmine: *Mechanics*
Supervised by Bruce R. Sutherland (University of Alberta)

Antonia Kolokolovna: *Computational Logic*
Supervised by Eugenia Ternovska (Simon Fraser University)

Youngsuk Lee: *Atmospheric Modelling*
Supervised by Mary Catherine Kropinski and David Muraki (Simon Fraser University)

Wilson Lu: *Statistics*
Supervised by Derek Bingham (Simon Fraser University)

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

Jens Rademacher: *Dynamics/Scientific Computing*
Supervised by Michael Ward (UBC) and Ralf Wittenberg (Simon Fraser Univeristy)

Jonathan Walgate: *Quantum Information Science*
Supervised by Barry C. Sanders (University of California)

PIMS PDF Day
UBC, September 22, 2004

Jacob Shapiro (PIMS PDF, UBC): *Introduction to Curve Counting*
Gromov-Witten invariants in algebraic geometry are new deformation invariants coming from ideas in string theory. Naively they count complex curves satisfying certain topological conditions sitting in a given variety.

Kyungkeun Kang (PIMS PDF, UBC): *On boundary regularity to the Stokes system and Navier-Stokes equations*
We study regularity problem for the Stokes system and the Navier-Stokesequations near boundary. For the steady-state case we obtained local estimates of the Stokes system "without pressure" and as its application we obtained the partial regularity result up to the boundary for the stationary Navier-Stokes equations in five dimension. For the non-stationary Stokes system we constructed an example, which shows, unlike in the interior case, Hölder continuity does not imply smoothness in the spatial variable near boundary. For the Navier-Stokes equations we proved that weak solutions, which is locally in $L^{p,q}$ with 2/p+n/q=1, q>n near boundary are regular up to the boundary. In three dimension it was shown that "suitable weak solutions" of the Navier-Stokes equations are regular near boundary provided that the scaled $L^{r,s}$-norm with 3/r+2/s=2, 2<s<infinity of the velocity field is sufficiently small.

Dominic Brecher (PIMS PDF, UBC): *Coupling D-branes to gravity*
I will show how D-branes enter into string theory, and describe their effective actions. I will then discuss some recent work of mine which shows how to couple these actions to gravity.

Jian Ying Zhang (PIMS PDF, UBC): *Some work on a class of generalized Newtonian fluids*
A non-Newtonian fluid is a fluid whose stress depends nonlinearly

on the strain, i.e. the fluid viscosity depends on the force applied, and sometimes time and temperature as well. This leads to complicated flow behaviors but very interesting mechanical properties of non-Newtonian fluids. (1) Dispersion effects in the miscible displacement of two fluids in a duct of large aspect ratio. (Joint with Ian Frigaard)(2) The propagation of a gas bubble in a cylindrical column filled with a viscoplastic fluid. (Joint with Ian Frigaard and Neville Dubash) (3) Yield stress effects on the Rayleigh-Benard problem. (Joint with Ian Frigaard and Mark Martinez)

Omer Angel (PIMS PDF, UBC): *Various subjects in probability*

Jens Rademacher (PIMS PDF, UBC): *Self-replication of pulses: organizing centers for backfiring, tracefiring and pulse-splitting*
Over the past decade travelling pulse solutions of several different reaction-diffusion systems have been mainly numerically observed to undergo instabilities which lead to periodic formation of secondary pulses, i.e. pulse chains of increasing length. We present some of these simulations and outline explanations in terms of organizing centers for different aspects and cases of the phenomenon, including growing domains.

Jae-Hun Jung (PIMS PDF, UBC): *Spectral methods for discontinuous problems*
My interests are in the spectral approximation of PDEs. Spectral methods yield the so-called spectral convergence when the solution is smooth. However, if the solution is nonsmooth or discontinuous, the overall convergence is only O(1/N). I develop spectral methods for discontinuous problems. In this talk, I will briefly describe the projects I am currently working on: 1) the resolution of the Gibbs phenomena 2) spectral methods for the relativistic problems and 3) spectral methods for kinetic equations.

Paul Chang (MITACS PDF, UBC): *Electrical and Thermal Coupling in Proton Exchange Membrane Fuel Cells*
A mathematical model describing the effects of electrical and thermal coupling of proton exchange membrane unit fuel cells through shared bipolar plates is developed. The unit cell model, developed by Berg et al. (2004), couples the consumption of reactants in the flow field channels to the current density and water content in the polymer membrane. Differing current density profiles in neighboring cells leads to in-plane currents in the bipolar plates, and the redistribution of current is governed by the nonlocal voltage equations. Thermal transport is decoupled into the in-plane and cross-plane directions; this is reasonable because of the large aspect ratio of the typical fuel cell geometry and the large in-plane to cross-plane conductivity ratio. Numerical results showing the effects on stack voltage and current density due to anomalous oxidant and coolant flow rates in the center cell are shown. It is shown that both electrical and thermal coupling have a significant effect on fuel cell performance.

Press Release: New Result about Prime Numbers Discovered by PIMS PDF in Vancouver

PIMS Postdoctoral Fellow, Ben Green, together with Terence Tao from UCLA, proved a new result about prime numbers. This result was announced in the 21 May 2004 issue of Science, the major scientific journal in America, which only rarely publishes papers on mathematics.

Prime numbers are those which cannot be exactly divided by any other numbers (except 1). Prime numbers have been studied for thousands of years. For instance, the fact that the sequence of prime numbers:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 43, ...

is infinite, that is to say, goes on forever, was already known to the Greek mathematicians of the fifth century BC.

Ben Green and Terence Tao proved that, given any number n, there are infinitely many sequences consisting of exactly n evenly spaced primes.

To see what Green and Tao's result means, notice that the full sequence of prime numbers begins with 2, 3, 5, 7. Here 3, 5, 7 are evenly spaced at intervals of 2. Is there any other sequence of three evenly spaced prime numbers? Yes, if we run down the list, we find the next such sequence is 31, 37, 43, this time with an interval of 6 (and a further prime number, 41, lying between the two last ones). Are there more? Yes, as we go further down the list we find more, and in fact the Dutch mathematician Johannes van der Corput proved in 1939 that there are infinitely many sequences of three evenly spaced prime numbers.

What about sequences of four evenly spaced prime numbers? There are such sequences, and Green and Tao set out to prove that there are infinitely many, precisely as in the case of three. They got much more than they expected. In fact, they proved that, not only for n=3 or n=4, but for any number n, there will be infinitely many sequences of n evenly spaced prime numbers. For instance, there is a sequence of ten evenly spaced prime numbers starting with 199, and continuing at intervals of 210 until 2089. Green and Tao tell us that there are many more, in fact infinitely many. They tell us also that somewhere in the list there is a sequence of one billion evenly spaced primes, although presumably they are so far down the list and the interval between them is so large that no computer will ever reach them.

Pacific Northwest Seminar Series

These are annual or biannual meetings that bring together various regional groups of mathematicians in areas represented by strong communities in British Columbia, Alberta, Washington, Oregon and Northern California. Some of the scientific goals of PIMS, e.g. promoting communication and interactions among mathematical scientists, are served by ad hoc organizations formed in Western Canada and the U.S. Pacific Northwest.

The PNW meetings form the backbone of the PIMS Collaborative Research Groups.

Pacific Northwest Number Theory Seminar

April 17, 2004 at Oregon State University

Organizer: Peter Borwein (SFU).

The April 2004 Pacific Northwest Number Theory Seminar speakers were:
Nils Bruin (Simon Fraser University): *Visualization as a Tool to Bound Mordell-Weil Ranks*
Ben Green (University of British Columbia): *Freiman's Theorem*
Ralph Greenberg (University of Washington): *Iwasawa Invariants for Elliptic Curves*

The First Pacific Northwest Theory Day

May 1, 2004 at Microsoft Redmond, Washington

Organizers: Bruce Kapron (University of Victoria) and David Wilson (Microsoft)

The goal of the first Pacific Northwest Theory Day was to bring together researchers in theoretical computer science from universities and research labs in the Pacific Northwest, and to present current work in the area thorough a program of research and survey talks. The workshop was attended by over 50 graduate students, postdoctoral fellows, professors and researchers from a number of institutions in the area; including Microsoft, Simon Fraser University, University of British Columbia, University of Victoria, and University of Washington.

The May 2004 Pacific Northwest Theory Day speakers were:

Assaf Naor (Microsoft Research): *Grothendieck's Inequality and Semidefinite Rounding*
Venkatesan Guruswami (University of Washington): *List Decoding of Codes: Recent Progress and Challenges Ahead*
William Evans (University of British Columbia): *Optimal Video-on-Demand Protocols to Minimize Worst Case Delay*
Valentine Kabanets (Simon Fraser University): *Buying Efficiency with Random Coins: Computational Randomness and Computational Hardness*
Venkatesh Srinivasan (University of Victoria): *Communication Versus Computation*

MITACS-PIMS Pacific Northwest Bioinformatics Day

May 20, 2004 at Simon Fraser University

The speakers were:

Jeremy Buhler (Washington University, St. Louis): *Seed Design for DNA Similarity Search with the Mandala System*
Anne Condon (University of British Columbia): *On the Generality of Algorithms for Pseudoknotted RNA Secondary Structure Prediction*
Peter Unrau (Simon Fraser University): *RNA Catalysis and Sequence Space Diversity*
Can Alkan (Simon Fraser University): *RNA-RNA Interactions and miRNA Target Prediction*
Jano Manuch (Simon Fraser University): *Inverse Protein Folding in 2D HP Model*

Pacific Northwest Probability Seminar

October 23, 2004

Organizers: Chris Burdzy (University of Washington), Zhenqing Chen (University of Washington), Ed Perkins (University of British Columbia), Qi-Man Shao (University of Oregon), Ed Waymire (Oregon State University).

The Pacific Northwest Probability Seminar speakers were:

Mina Ossiander (Oregon State University): *A Probabilistic Representation of Solutions to Incompressible Navier-Stokes Equations*
Rick Kenyon (University of British Columbia): *Asymptotes of Random Crystalline Surfaces*
Ofer Zeitouni (University of Minnesota): *Brinbaum Lecture: Results and Challenges in the Study of Multi-Dimensional Random Walks in Random Environments*
Oded Schramn (Microsoft Research): *Sensitivity, Complexity, Harmonic Analysis and Exceptional Times of Boolean Functions*

Combinatorial Potlatch

November 20, 2004

Organizer: Petr Lisonek (SFU).

Combinatorial Potlatches have been held for many years at various locations around Puget Sound and southern British Columbia, and are an opportunity for combinatorialists to gather informally for a day of invited talks and conversation. The American Heritage Dictionary defines "potlatch" as: A ceremonial feast among certain Native American peoples of the northwest Pacific coast, as in celebration of a marriage or an accession, at which the host distributes gifts according to each guest's rank or status. Between rival groups the potlatch could involve extravagant or competitive giving and destruction by the host of valued items as a display of superior wealth. [Chinook Jargon, from Nootka p'achitl, to make a potlatch gift.]

The 2004 speakers were:

Xuding Zhu (National Sun Yat-Sen University, Taiwan): *The Game Chromatic Number of a Graph*
John Grimbel (University of Alaska, Fairbanks): *The Traveling Sales Rep Gets Into Abllian Groups*
Jozsef Solymosi (University of British Columbia): *Bounds on Incidences and Problems From Additive Number Theory*

Pacific Northwest String Seminar

January 29–30, 2005 at the University of British Columbia

Organizer: Dominic Brecher (PIMS PDF, UBC).

The speakers were:

D. Berenstein (University of California, Santa Barbara): *The Structure of Half BPS States in the Ads/CFT Correspondence*
S. Giddings (University of California, Santa Barbara): *Locality and Black Hole Information*
P. Horara (University of California, Berkeley): *Topology Changing Transitions in Bubbling Geometries*
C. Johnson (University of Southern California): *Backlund Transformation and D-Branes in Minimal String Theory*
A. Karch (Washington University): *On the dS/dS Correspondence*
P. Koerber (University of British Columbia): *Supertubes and the 4D Black Hole*
E. Silverstein (Stanford): *Topology Change, Baby Universes and de Sitter Solution: From String Compactification on Riemann Surfaces*
M. Strasser (Washington University): *Bending Minds and Space: Regge Scattering in QCD and String Theory*

West Coast Optimization Meeting

April 10, 2004, University of Washington

For more information please see **http://www.math.washington.edu/~burke/wcom04/**.

UW: Red Square near dusk

PIMS Lecture Series

PIMS lectures series include:

- PIMS Algebraic Geometry Seminar at UBC
- PIMS Algebraic Topology Seminar at UBC
- PIMS Distinguished Lecture Series at PIMS Sites
- PIMS-MITACS Math Biology Seminar at U. Alberta
- PIMS Number Theory Seminar at UBC and SFU
- PIMS PDE/Geometry Seminar at UBC
- PIMS Probability Seminars at UBC
- PIMS Problems In Discrete and Combinatorial Math Seminar at UBC
- PIMS-Shell Lunchbox Lecture Series at Shell Centre, Calgary
- IAM-PIMS-MITACS Joint Distinguished Colloquium Series at UBC
- PIMS-MITACS Financial Seminar Series at UBC
- PIMS/MITACS Mathematical Biology Seminars at UBC
- UBC Mathematics Department Colloquium Hosted by PIMS-UBC
- PIMS/SFU Computing Science Distinguished Lecture Series at SFU
- Centre for Scientific Computing - a PIMS/MITACS Event at SFU
- PIMS Alberta Topology Seminar at the University of Alberta and the University of Calgary
- UBC/SFU Joint Seminar in Statistics in Vancouver
- Syncrude/PIMS/AMI Lecture Series at the University of Alberta

PIMS Algebraic Geometry Seminars, UBC

Organizer: *Jacob Shapiro (PIMS PDF, Math, UBC).*

The 2004/05 seminars included:

Ravi Vakil (Stanford University): *Double Hurwitz Numbers and the Intersection Theory of the Moduli Space of Smooth Curves*, April 1, 2004
Andrei Mustata (UBC): *The Orbiford Chow Ring of Toric Deligne-Mumford Stacks Part II*, April 7, 2004
Kai Behrend (UBC): *The Orbiford Chow Ring of Toric Deligne-Mumford Stacks Part III*, April 8, 2004
Kevin Purbhoo (UC Berkeley): *Horn-Type Inequalities for the Lagrangian Grassmamian*, April 28, 2004
Amin Gholampour (UBC): *The Equivariant Gromov-Witten Theory of P"2 Bundles Over Curves*, October 6, 2004
Kiumais Kaveh (UBC): *Vector Fields and Doebeault Equivariant Cohomology*, October 13, 2004
Anca Mustata (UBC): *The Chow Ring of a Weighted Blow-up of a Regularly Local Embedding Part I*, October 27, 2004
Anca Mustata (UBC): *The Chow Ring of a Weighted Blow-up of a Regularly Local Embedding Part II,* November 3, 2004

Jessica Young (U. Illinois@ Urbana-Champaign): *Mordell-Lang's Conjecture for Function Fields: A Proof From Logic (due to Udi Hrushouski) Part I,* November 24, 2004
Jessica Young (U. Illinois@ Urbana-Champaign): *Mordell-Lang's Conjecture for Function Fields: A Proof From Logic (due to Udi Hrushouski) Part II.* December 1, 2004
Alistair Savage (U. Toronto) *Quiver Varieties and Representation Theory Parts I and II,* December 9, 2004
Tom Coates (Havard University): *Floer Homology, Quantization, and Gromov-Witten Theory Part I*, January 24, 2005
Tom Coates (Havard University): *Floer Homology, Quantization, and Gromov-Witten Theory Part II*, January 25, 2005
Tom Coates (Havard University): *Floer Homology, Quantization, and Gromov-Witten Theory Part III,* January 26, 2005
Tom Coates (Harvard University): *Floer Homology, Quantization, and Gromov-Witten Theory Part IV*, January 27, 2005
Mitja Mastnak (UBC): *About Hoff Algebra Extensions and Cohomologies*, February 2, 2005
Angelo Vistoli (University of Bologna): *Chow Rings of Classifying Spaces for Classical Groups*, February 9, 2005
Megumi Harada (U. Toronto): *Computation of Generalized Equivalent Cohomologies of Kac-Moody Flag Varieties*, February 10, 2005
Julianna Tymoczko (University of Michigan): *Generalizing Group Exponents Using the Topology of Subvarieties of the Flag Varieties*, February 23, 2005
Sergei Krutelevich (U. Ottawa): *The Freudenthal Construction and Orbits of Exceptional Groups*, February 24, 2005
Nils Bruin (SFU): *The Arithmetic of Prym Varieties in Genus 3 (With Applications to Finding the Rational Points on Curves),* March 9, 2005
Kevin Purbhoo (UBC): *A Nullstellenstaz for Amoebas* , March 16, 2005
Davesh Maulik (Princeton University): *A Topological View of Gromov-Witten Theory,* March 23, 2005
Michael Roth (Queen's University): *Stable Maps and Quot Schemes,* March 30, 2005

PIMS Algebraic Topology Seminars, UBC

Organizer:
Laura Scull
(Math, University of British Columbia).

The 2004/05 seminars included:

Duane Randall (Loyla University New Orleans): *Self-coincidences of Maps from S^q-bundles over S^n to S^n*
Kee Y. Lam (UBC): *Fast-Tracking into Characteristics Classes*, September 23, 2004
Izak Grguric (UBC): *Equivariant Characteristics Classes*, September 30, 2004
Laura Scull (UBC): *An Introduction to Model Categories,* October 7, 2004
Liam Watson (UBC): *Braid Group Actions and the Jones Polynomial*, October 14, 2004
Carl Gladish (UBC): *Spin Vector Bundles*, October 28, 2004
Yun Feng Jiang (UBC): *Introductions to Orbifolds and Orbifold (Chen-Duan) Cohomology*, November 4, 2004
John Macdonald (UBC): *Monoids, Monads and Models*, November 18, 2004
Graham Denham (Mathematical Sciences Research Institute): *Braid Group Actions and the Jones Polynomial*, November 25, 2004
Krishnan Shankar (University of Oklahoma): *Dehn Functions for Finitely Presented Groups*, January 10, 2005
Dylan Thurston (Harvard University): *A Random Tunnel-Number One 3-Mainfold Does Not Fiber Over the Circle*, January 13, 2005
Sunil Chebolu (University of Washington): *Subcategories and K-Theory for Trianqulated Categories*, January 26, 2005
Nansen Petrosyan (University of Wisconsin-Madison): Groups with Periodic Cohomology, February 2, 2005
Jospeh Maher (Califorina Institute of Technology): *Heegaard Splittings and Virtual Fibers*, February 8, 2005
Jeff Smith (Purdue University): *The Homotopy Theory of the Alperin Conjecture*, February 21, 2005
Johann Leida (University of Wisconsin-Madison): *Novel Homotopy Groups for Orbifolds Part I*, March 16, 2005
Johann Leida (University of Wisconsin-Madison): *Novel Homotopy Groups for Orbifolds Part II*, March 23, 2005

PIMS Distinguished Lecture Series, PIMS Sites

Organizers: PIMS Site Directors

The 2004/05 lectures included:
Ben Green (UBC): *Arithmetic Progressions of Primes*, April 27, 2004
Norberto Kerzman (University of North Carolina at Chapel Hill): *An Introduction to Several Complex Variables. A Survey for Graduate Students*, November 19 and 26, 2004

PIMS-MITACS Math Biology Seminar, U. Alberta

The 2004/05 PIMS funded seminars were:

Organizer:
Mark Lewis (Math, University of Alberta).

Mr. Gustavo Carrero (University of Alberta): *Modelling the Compartmentalization of Splicing Factors*, September 27, 2004
Dr. Joanna Renclawowicz (PIMS PDF, University of Alberta and University of Victoria): *Travelling Waves and Spread Rate for West Nile virus Model,* October 4, 2004
Dr. Roger Nisbet (PIMS Distinguished Visitor, Department of Biological Sciences, University of California): *Population Dynamics with Unidirectional Flow*, October 12, 2004
Dr. Roger Nisbet (PIMS Distinguished Visitor, Department of Biological Sciences, University of California): *Ecological Indicators*, October 14, 2004
Mr. Petro Babak (University of Alberta): *Dynamics of Group Formation in Collective Motion of Organisms,* October 18, 2005
Dr. Tim Robbins (University of Utah and University of Alberta): *Biological Invasions in Heterogeneous Environments,* October 25, 2004
Dr. Eric Cytrynbaum (Department of Mathematics, UBC): *An Experimental and Theoretical Study of the Forces Involved in Mitotic Spindle Formation*, November 1, 2004
Dr. Gary de Young (King's University College): *The De Young-Keizer Model for Calcium Oscillations*, November 8, 2004
Dr. Karl Hadeler (Lehrstuhl fur Biomathematik University of Tubingen): *Persistence of Fungal Endophytes in Grass Populations*, November 4, 2004
Dr. Marjorie Wonham (University of Alberta): *Temporal Increases in Biological Invasions: using models to distinguish among mechanisms*, November 22, 2004
Dr. Piotr Weclaw (University of Alberta): *Practical Application of a Computer Simulation Model in Ecological Conversation*, November 29, 2004
Dr. Jorge Velasco-Hernandez (Mexican Petroleum Institute): *Modelling biofilm Structure and Growth Dynamics*, December 1, 2004
Dr. Markus Owen (University of Nottingham): *Multiphase Models for Macrophage Chemotaxis and Cancer Immunotherapy*, December 3, 2004
Dr. Abba Gumel (Institute of Industrial Mathematical Sciences, University of Manitoba): *Mathematical Approaches for Assessing Potential Impact of HIV Vaccines*, December 6, 2004
Dr. Kevin Hall (Laboratory of Biological Modelling National Institute of Health): *Mathematical Modelling of In vivo Human Energy Metabolism and the Regulation of Body Composition,* January 17, 2005
Dr. Thomas Hillen (University of Alberta): *Modelling with Coupled Systems and Quiescent States,* February 7, 2005
Dr. Caroline Bampfylde (University of Alberta): *Mathematical Modelling of Rain Forest Regeneration Dynamics: A Case Study in Sabah Malaysis,* February 28, 2005
Mr. Jose Candelaria (University of Iowa): *Construction and Analysis of Two Habitat Specific Dispersal Models,* March 7, 2005
Dr. Erik Noonburg (University of Alberta): *Cervus Elaphus, Quo Vadis? A Game Theoretic Approach to Modelling Elk Movements Patterns in Yellowstone National Park,* Mrch 14, 2005
Dr. Cailin Xu (University of Alberta): *Seasonality and Population Cycles: Forced Prey Growth or Forced Functional Response?* March, 21, 2005

PIMS Number Theory Seminar, UBC and SFU

Organizers:
Greg Martin (Math, UBC) and Stephen Choi (Math, SFU, picutred).

The 2004/05 seminars included:

Greg Martin (UBC): *Lots of Digits, Lots of Decimal Places,* September 16, 2004
Stephen Choi (SFU): *On Linear Independence of Certain Multivariate Infinite Products,* September 16, 2004
Idris Mercer (SFU): *Norms of Zero-One Polynomials and the Ubiquity of Sidon Sets*, October 14, 2004
Frank Chu (UBC): *An Old Conjecture of Erdos and Twin on Additive Bases*, October 14, 2004
Michael Bennett (UBC): *A Tale of Two Surfaces*, January 27, 2005
Greg Fee (SFU): *Finding a Solution to the Sum of Squares Problems*, January 27, 2005

Brian Conrad (University of Michigan): *Irreducible Specialization in Characteristics 2*, March 3, 2005
Bill Casselman (UBC): *How (not) to Teach an Introductory Course in Automorphic Forms*, March 3, 2005
Carl Pomerance (Dartmouth College): *Ivan and Betty Niven Distinguished Lecture Periods of Pseudorandom Number Generators*, March 23, 2005
Alexa van der Waall (University of Sydney): *Factorisation of Differential Operators Over Laurent Series Rings*, March 23, 2005

PIMS PDE/Geometry Seminar, UBC

The 2004/05 seminars included:

Organizer: *Tai-Peng Tsai (Math, UBC).*

Gustavo de Oliveria (UBC): *Reducibility of Two-Level Systems Under Quasi-Periodic Perturbatis NS*, September 14, 2004
Jens Rademacher (UBC): *A Pathfollowing Approach to the Computation of Spectra of Travelling Waves*, September 21, 2004
Yu Yan (UBC): *Compactness Results Related to Scalar Curvature Deformation*, September 28, 2004
Alexi Cheviakov (UBC): *The Construction of Exact 3D Solutions of Plasma Equilibrium Equations in Different Geometries*, October 5, 2004
Nassif Ghoussoub, BIRS Scientific Director (UBC): *The Emden Equations with Boundary Singularities,* October 12, 2004
Abbas Moameni (UBC): *On the Existence of Solutions to Quasilinear Schrodinger Equations,* October 19, 2004
David Brydges (UBC): *Finite Range Decompositions of Positive Definite Functions,* November 2, 2004
Joel Feldman (UBC): *The Renormalization Group,* November 8, 2004
Kyungkeun Kang (UBC): *Schrodinger Flow Near Harmonic Maps,* November 16, 2004
Frederic Robert (University of Nice, France): *Compactness and Asymptotic Estimates for 4th Order Paneitz-Type Equations,* November 23, 2004
Qingean Xia (University of Texas at Austin): *Ramified Phenomena in Optimal Transportion,* January 5, 2005
Katrin Wehrheim (IAS): *Hofer's Scale Calculus for Moduli Spaces,* January 11, 2005
Yu Yan (University of Washington): *A Bernstein Problem for Special Lagragian Equations,* January 25, 2005
David Ambrose (Courant Institute of Mathematical Sciences, New York University): *Well-Posedness Results for Water Waves and Related Problems,* January 27, 2005
Arpad Benyi (University of Massachusetts): *Recent Results on Bilinear Pseudo-Differential Operators,* February 3, 2005
Ivar Ekeland (UBC): *Regularity in an Unusual Variational Problem,* February 22, 2005
Xiaodong Yan (Michigan State University): *An Example in 2D Nonlinear Elasticity,* March 8, 2005
Fengeo Han (Michigan State University): *The Sobolev Inequality for Paneitz Operator on Berger Spheres,* March 8, 2005
Michael Lacey (Georgia Institute of Technology): *Commutators in Several Parameters,* March 15, 2005
Louis Nurenberg (New York University): *A Geometric Problem and its Connection to the Hopf Lemma,* March 17, 2005
Vitali G. Vougalter (Notre Dame University): *Eigenvalues of Zero Energy in the Linearized NS Problem,* March 22, 2005
Jerome Demange (University of Paul Sabatier, Toulouse, France): *Porous Media Equations and Sobolev Inequalities on Manifolds,* March 29, 2005

PIMS Proability Seminars, UBC

Organizer: *Alexander E. Holroyd (Math, UBC)*

The 2004/05 seminars included:

John Walsh (UBC): *Some Remarks on the Numerics of the Nonlinear Stochastic Wave Equation,* March 30, 2005
Alexander Roitershtein (UBC): *On Multi-Type Branching Processes with Immigration in Random Environment,* March 23, 2005
Richard Bass (University of Connecticut): *Renormalized Self-Intersection Local Time and the Range of Random Walks,* March 9, 2005
Alain-Sol Sznitman (ETH Zurich): *An Invariance Principle for Isotropic Diffusions in Random Environment,* March 2, 2005
Alain-Sol Sznitman (ETH Zurich): *On Random Walks in Random Environment,* February 23, 2005
N. Krylov (University of Minnesota): *The Dirichlet Problem*

and Diffusion Processes in the Space of Four Dimensions More, January 26, 2005
Takashi Kumagai (Research Institute for Mathematical Sciences, Kyoto University): *A Trace Theorem for Dirichlet Forms on Fractals,* November 24, 2004
Omer Angel (UBC): *Multi-type Totally Asymmetric Simple Exclusion Processes,* November 17, 2004
Yaozhong Hu (University of Kansas): *Self-Intersection Local Time of Fractional Brownian Motion,* November 10, 2004
David Wilson (Microsoft Research): *Balanced Boolean Functions that can be Evaluated so that Every input bit is unlikely to be Read,* November 3, 2004
Zhen-Qing Chen (University of Washington and UBC): *Traces of Symmetric Markov Processes,* October 27, 2004
Codina Cotar (UBC): *Lilypond-type Growth Models,* October 20, 2004
Tony Guttmann (University of Melbourne): *On Rook's Tour-or Walks Crossing a Square,* October 13, 2004
Omer Angel (UBC): *Random Planar Maps II,* October 6, 2004
Omer Angel (UBC): *Random Planar Maps I,* September 29, 2004
Ted Cox (Syracuse University): *Recent Results for a Stochastic Spatial Lotka-Volterra Model,* September 22, 2004
Andreas Greven (University of Erlangen, Germany): *On Mutually Catalytic Branching,* September 15, 2004
Erwin Bolthausen (Institut fur Mathematik, U. Zurich): *Spin Glasses III,* June 28, 2004
Erwin Bolthausen (Institut fur Mathematik, U. Zurich): *Spin Glasses II,* June 25, 2004
Erwin Bolthausen (Institut fur Mathematik, U. Zurich): *Spin Glasses I,* June 21, 2004

PIMS Problems in Discrete and Combinatorial Math Seminar, UBC

Organizer:
Stefanie Van Willigenberg (UBC).

The 2004/05 seminars included:

Peter Keevash (The Califorina Institute of Technology): *The Role of Approximate Structure in Extremal Combinations*, September 14, 2004
Jonathan Jedwab (SFU): *Constructuring Binary Sequences with Merit Factor Greater than 6.34*, September 28, 2004
Guang Yue Han (SFU): *Multiple Antenna Communication Systems and Packing Problems on Compact Lie Groups*, October 12, 2004
Kristin Shaw (UBC): *Multiplicity Free Expansion of Schur P Functions*, October 26, 2004
Wael Bahsoun (University of Victoria): *Position Dependent Random Maps and Generalized Skew Products*, November 16, 2004
Steph van Willigenburg (UBC): *Decomposable Compositions and Equality of Ribbon Schur Functions,* November 30, 2004
Anders Buch (Aarhus University): *Formulas for Quiver Varieties*, January 25, 2005
Joshua Cooper (New York University): *Generalized de Bruijn Cycles*, February 1, 2005
Dimitris Achlioptas (Microsoft): *Phase Transitions in Hard Optimization Problems*, February 8, 2005
Abdelmatek Abdesselam (UBC): *Feynman Diagrams, Classical Invariant Theory, Resultants and the Hadamaid-Foulkes-Howe Conjecture*, February 22, 2005
Richard Anstee (UBC): *Some New and Interesting Results in Matching Theory*, March 1, 2005
Matthew Morin (UBC): *The Chormatic Symmetric Function of Caterpillars*, March 8, 2005
Shlomo Hoory (UBC): *Simple Permutations Mix Well: Joint Work with Alex Brodsky*, March 15, 2005
Federico Ardila (Microsoft Research): *The Bergman Complex of a Matroid and the Space of Phylogenetic Trees*, March 22, 2005
Roger Woodford (UBC): *Prime Symmetric Divison Function*, March 29, 2005

PIMS/Shell Lunchbox Lecture Series, Shell Centre, Calgary

Organizer:
Gary Margrave (U. Calgary).

PIMS is presenting a series of lectures at the Shell Centre in downtown Calgary. These lectures, given by experts from the PIMS Universities, focus on mathematical techniques and applications relevant to the oil and gas industry and demonstrate the utility and beauty of applied mathematics. The talks are aimed at a general audience. Attendance may qualify for APEGGA Professional Development Hours.

The 2004/05 seminars included:

Reginald Paul (University of Calgary): *Ionic Transport in Polyelectrolyte Membranes Used in Fuel Cells: A Molecular Perspective,* April 8, 2004
David Feder (University of Calgary): *Bose-Einstein Condensates: A New Phase for Research,* April 16, 2004
Barry Sanders (iCORE Professor for Quantum Information Sciences University of Calgary): *Quantum Information*

Science, September 29, 2004
Kristine Bauer (University of Calgary): *Four Colours Suffice: Planar Graphs, Colourings and Topology,* October 26, 2004
Rod Blais (University of Calgary): *Spherical Harmonic Transforms and Multiresolution Applications,* November 10, 2004
Lou Fishman (MDF International): *Classical Wave Propagation, Quantum Physics and Modern Mathmatical Asymptotics-The Holy Trinity of Classical Wave Theory,* December 7, 2004
Scott Taylor (University of Calgary): *Economic Growth and the Convergence in Carbon Emissions Across Countries,* February 16, 2005
Renate Scheidler (University of Calgary): *Cryptography-The Art of Secret Writing-From Old to New,* March 15, 2005
David Hobill (University of Calgary): *Extracting the Physics from Simulations in General Relativity,* March 23, 2005

IAM-PIMS-MITACS Joint Distinguished Colloquium Series, UBC

Organizer:
Michael Ward
(IAM Director, UBC).

This series of seminars is co-hosted by the Institute for Applied Mathematics at UBC and PIMS.

The 2004/05 seminars included:

George Homsy (University of California, Santa Barbara): *Novel Marangoni Flows,* September 20, 2004
Ray Goldstein (University of Arizona): *A Stirring Tale of Bacterial Swimming and Chemotaxis,* October 25, 2004
Andrea Bertozzi (University of California, Los Angeles): *Higher Order PDEs in Image Processing,* November 29, 2004
Roger Brockett (Harvard University): *Dynamical Systems That Do Tricks,* January 24, 2005
Adrian Nachman (University of Toronto): *Inverse Problems in Medical Imaging,* March 7, 2005
Ray Pierrehumbert (University of Chicago): *Early Life Crises of Habitable Planets,* March 28, 2005

These lectures were taped and are available at **http://www.pims.math.ca/industrial/2004/iampims_lect/**.

PIMS-MITACS Financial Seminar Series, UBC

Organizer:
Ulrich Haussmann
(Math, UBC).

In conjunction with research activities of MITACS, PIMS hosts a series of talk on recent work in financial mathematics.

The 2004/05 seminars included:

Dirk Becherer (Imperial College, London): *On Futures Prices*

in Supermartingale Term Structure Models, June 14, 2004
Joern Sass (Johann Radon Institute for Computational and Applied Mathematics, Linz Austria): *Utility Maximization Under Transaction Costs in the CRR Model,* June 16, 2004
Harjoat Bhamra (UBC): *The Effect of Financial Innovation on Stock Market Volatility,* January 27, 2005
Abel Cadenillas (University of Alberta): *Classical and Impulse Control for the Optimization of the Risk and Dividend Policy,* February 10, 2005
Ronnie Sircar (Princeton University): *Valuation on Employee Stock Options,* February 17, 2005
Tony Ware (University of Calgary): *Natural Gas Option Pricing Under Mean-Reverting Price Models,* February 24, 2005
Alexander Melnikov (University of Alberta): *Quantile Hedging and Valuation of Equity-Linked Life Insurance Contracts,* March 3, 2005
Sebastin Ferrando (Ryerson University): *Martingales and Wavelets: Applications to Hedging Financial Derivatives,* March 10, 2005
Ivar Ekeland (UBC): *Option Pricing Under Information Asymmetry,* March 17, 2005
Ulrich Horst (UBC): *Non-ergodic Stock Price Dynamics in a CAPM with Interacting Agents,* March 31, 2005

PIMS/MITACS Mathematical Biology Seminars, UBC

Organizer: *Leah Keshet (Math, UBC).*

The 2004/05 seminars included:

Donald Ludwig (UBC): *Biodiversity and Precaution,* April 14, 2004
Steven Viscido (University of Washington): *Emergent Properties of Fish Schools: A Comparison of Observation and Theory,* April 28, 2004
Franziska Michor (Harvard University): *Somatic Evolution of Cancer,* May 12, 2004
Ehud Meron (Ben Gurion University): *Ecosystems Engineers: From Pattern Formation to Habitat Creation,* July 21, 2004
Rustom Anita (Emory University Atlanta): *Modelling the Dynamics of CD8 Responses,* July 26, 2004
Edward Green (University of Nottingham): *Mathematical Modelling of Liver Cells Aggregation Invitro,* July 28, 2004
JK Percus (New York University): *Small Population Effects in Stochastic Population Dynamics,* July 28, 2004
Ora E. Percus (New York University): *Can Two Wrongs Make a Right? Coin Tossing Games and Parrondo's Paradox,* August 4, 2004
James Keener (University of Utah): *A Model of Length Control of Flagellar Hooks of Salmonella Typhimunium,* August 11, 2004
Edwin Munro (University of Washington): *Dynamics of Cell Polarization in the Early C. Elegano Embryo: Regulatory Gene Networks Meet Cortical Mechanics,* September 15, 2004
Alex Mogilner (UC Davis): *Monte Carlo Simulations and Probabilistic Analysis Shed Light on How Microtubules Search in Space,* September 27, 2004
James D. Johnson (UBC): *New Roles For Intracellular Calicum Stores in Pancreatic Beta-Cells,* November 10, 2004
Ivan Robert Nabi (UBC): *Autocrine Receptor Activation and the Regulation of Tumour Cell Motility,* November 17, 2004
Karl P. Hadeler (University of Tubingen): *Reaction Transport Systems and Applications to Biology,* November 22, 2004
Carl T. Bergstrom (University of Washington): *Mathematical Models of RNS Silencing: An Intracellular Immune System Uses Multiple Synergistic Mechanism to Avoid Autoimmunity and Pathogen Subversion,* December 1, 2004
Laurence Ward (UBC): *On the Role of Synchronous Neural Oscillations in Cognitive Processes,* December 8, 2004
Raibatak Das (Cornell University): *Real Time Cross-Correlation Image Analysis of IgE Receptor Signaling,* December 13, 2004
Anmar Khadra (Institute of Applied Mathematics): *The Synchronization of Chaos-Generating Systems Using Impulsive Control Techniques with Applications to Communication Security,* January 5, 2005
Fred Brauer (UBC): *The Kermack-McKendrick Epidemic Model Revisited,* January 12, 2005
Dan Luciani (Technical University of Denmark): *Self-Sustained and Forced Oscillations of Cytosolic Ca2 and Glucose Metabolism in Pancreatic Islets,* January 21, 2005
Dan Beamish (York University): *50 Years Later: A Neurodynamic Explanation of Fitts' Law,* January 26, 2005
Jonathan B. Albertus (Friday Harbor Labs): *In Silico Reconstruction of Listeria Motility Exhibts Complex Biological Behaviours,* February 2, 2005
Babk Pourbohloul (UBC): *Control of Respiratory-Borne Disease Outbreaks in Populations: A Contact Network Theory Approach,* February 9, 2005
Artem Cherkasov (UBC): *Reliability and Network Analysis in Genomics,* March 9, 2005
Jens Rademacher (UBC): *Global Bifurcations, Spectra and*

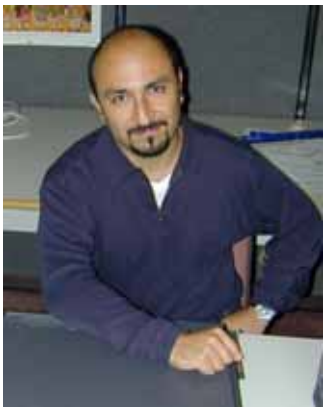
Dynamics of Travelling Waves, March 16, 2005
Yue-Xian Li (UBC): *Pulsatile Hormonal Signals Generated By Networks of Endosane Neurons: A Review of Recent Developments,* March 23, 2005
Gustavo Carrero (University of Alberta): *Modelling the Compartmentalization of Splicing Factors,* March 30, 2005

UBC Mathematics Department Colloquium Hosted by PIMS-UBC

The 2004/05 seminars included:

Michael Goldberg (CalTech): *Dispersive Bounds for the Schrodinger Equation With Almost Critical Potentials,* January 26, 2005
Joshua Cooper (New York University): *Quasirandom Permutations,* February 2, 2005
Dimitris Achlioptas (Microsoft): *Applications of Random Matrices in Spectral Computations and Machine Learning,* February 9, 2005
Sergeil Krutelevich (University of Ottawa): *Jordan Algebras, Exceptional Groups and Higher Composition Laws,* February 23, 2005

PIMS/SFU Computing Science Distinguished Lecture Series at SFU



Organizer:
S. Cenk Sahinalp
(CS, SFU).

The 2004/05 speakers were:

Mahdu Sudan (MIT): *List Decoding of Error-Correcting Codes,* September 17, 2004
Anna Karlin (University of Washington): *Game Theory, Economics and Computer Science,* November 18, 2004
Geoffrey Hinton (University of Toronto): *Learning to Perceive How Handwritten Characters were Drawn,* December 10, 2004
Jeffrey D. Ullman (Standford University): *Automated Management of Problem-Solving Homework,* January 18, 2005
Moshe Vardi (Rice University): *Untitled,* February 16, 2005
Laszlo Lovasz (Microsoft Research, Redmond): *Graph Homomorphisms, Statistical Physics, and Limits of Graph Sequences,* March 29, 2005

Centre for Scientific Computing - a PIMS/MITACS Event at SFU

Organizer:
Bob Russell
(CSC Director, SFU).

The 2004/05 speakers were:

Anna Cellar (Medical Imaging Research Group, Division of Nuclear Medicine, Vancouver Hospital and Health Sciences Centre): *Quantitative and Dynamic SPECT Imaging,* January 16, 2004
Mario Szegedy (Rutgers University): *Quantum in Computer Science,* January 16, 2004
Sarah Mitchell (UBC): *Applications of the box scheme to reactive transport problems,* February 20, 2004
Robert Bridson (UBC): *Scalable collision resolution in computer animation,* March 12, 2004
Anja Sturm (UBC): *Family tree of genes under the influence of selection and mutation,* March 19, 2004
Eldad Haber (SFU): *Optimization, PDE constraints and volume preserving image registration*, July 9, 2004
Jean-Luc Thiffeault (Imperial College of Science and Technology): *Measuring Topological Chaos,* August 11, 2004

MITACS

PIMS Alberta Topolgy Seminar at the University of Alberta

Organizer:
Kristine Bauer (Math, U. Calgary).

The 2004/05 speakers were:

Robin Cockett (University of Calgary): *Topology Without Points.* April 4, 2004
Peter Zvengrowski (University of Calgary): *The Span of Smooth Manifolds, A Survey,* April 4, 2004
George Peschke (University of Alberta): *Polynominal Approximations of Homotopy Functors, a Localization Point of View,* April 4, 2004
Jedrez Sniaticki (University of Alberta): *Differential Structure of Orbit Spaces,* April 21, 2004
Ioan James: *The Mind of Mathematician,* April 21, 2004
Elena Kudryavtseva (University of Calgary): *On Coincidence Points of Mapping Between Surfaces,* September 28, 2004
Volker Runde (University of Alberta): *Part 1 of the Introduction to Non-Commutative Topology,* September 28, 2004
Terry Gannon (University of Alberta): *Part 1 on Conformal Field Theory-A Survey,* September 28, 2004
Elena Kudryavtseva (University of Calgary): *Part 2 On Coincidence Points of Mapping Between Surfaces,* October 26, 2004
Igor Nikolaev (University of Calgary): *Part 2 in the Series on Non-Commutative Topology,* October 26, 2004
George Peschke (University of Alberta): *Homotopy Theoretical Properties of Quillen's Plus Construction,* October 26, 2004
Peter Zvengrowski (University of Calgary): *Ell_2-cohomology of Countable Discrete Groups,* November 16, 2004
Volker Runde (University of Alberta): *(Reduced) Group C*-Algebras and Amenala Groups,* November 16, 2004
Robin Cockett (University of Calgary): *The Manifold Construction and Its Relatives (Such as Orbifolds),* November 16, 2004
Haibo Ruan (University of Alberta): *An Axiomatic Approach to the Equivariant S1-degree; in MS 427,* December 9, 2004
Lassina Dembele (University of Calgary): *An Introduction to Modular Forms for Topologists,* December 9, 2004
Kalathoor Varadarajan (University of Calgary): *Multiplicative Sequences, Hirezeburch Index Theorem and the Statement of Novikov's Conjecture,* December 9, 2004
Elena Kudryavtseva (University of Calgary): *Coincidence points of pairs of mapping of 2-torus to a surface,* January 25, 2005
Terry Gannon (University of Alberta): *G. Segal's conformal field theory,* January 25, 2005
Peter Zvengrowski (University of Calgary): *ell_2-cohomology of countable discrete groups continued,* January 25, 2005
Elena Kudryavtseva (University of Calgary): *Periodic Solutions of the N-Body Problems and Applications to Planetary Systems With Satellites,* February 22, 2005
Wesley Maciejewski (University of Alberta): *Compact Manifolds, Tangential Vector Fields and their Surprising Relationships,* February 22, 2005
Igor Nikolaev (University of Calgary): *The Alexander Module: Algebra in Service of Topology,* February 22, 2005

Andrew Neitsch (University of Alberta): *The Kuratowski Complement and Closure Problem,* February 22, 2005
Peter Zvengrowski (University of Calgary): *ell_2-cohomology of countable discrete groups continued ,* March 22, 2005
Eva Krause (University of Alberta): *The antidiagonal as an element of the coset ring,* March 22, 2005
Kristine Bauer (University of Alberta): *Operads and the identity functor,* March 22, 2005

UBC/SFU Joint Seminars in Statistics in Vancouver

Organizers:
Rachel Altman (Stat, SFU) and Jason Loeppky (Stat, UBC).

The 2004/05 speakers were:

Charmaine Dean (SFU): *Phyiscal vs. Statistical Modelling: Towards Reconciliation,* January 27, 2005
Jim Zidek (UBC): *Problems in the Analysis of Spatial Longitudinal Data,* January 27, 2005

Syncrude/PIMS/AMI Lecture Series at the University of Alberta

This lecture series is sponsored by **Syncrude**, organized by PIMS in consultation with Syncrude, and hosted by the **Applied Mathematics Institute** (AMI) at the University of Alberta.

Daniel D. Joseph (U. Minnesota).

The 2004/05 speakers were:

Daniel D. Joseph (University of Minnesota): *Fluid Dynamics of Particle Formation,* June 4, 2004
Dr. Roland Glowinski (University of Houston): *Operator-Spliting Methods: Application to Continuum Mechanics and Geometry,* October 22, 2004
Barbara Lee Keyfitz (Fields Institute): *Hyperbolic Conservation Laws: Do We Need Proofs?* September 23, 2005
Bruno Eckhardt (Philipps-Universitat Marburg): *Transition to Turbulence in Shear Flows,* January 21, 2005

Alberta INNOVATION AND SCIENCE

AMI Applied Mathematics Institute

Syncrude Securing Canada's Energy Future

III. GENERAL SCIENTIFIC EVENTS

The participants of the International Conference on Differential Equations and Applications in Mathematical Biology, held in Nanaimo, BC, July 18-23, 2004.

Participants of the National Program on Complex Data Structures (NPCDS) workshop on Missing Data Problems.

Participants of the Knots in Vancouver Workshop which was held at UBC, July 19–23, 2004.

Extra-Thematic Scientific Workshops

Its unique structure allows PIMS to move quickly to produce and promote the latest advances in the mathematical sciences and involve PIMS' scientists in them. Rather than centering all its scientific activities around a few topics for an entire academic year, thus tying up resources and limiting participation, PIMS also runs shorter, more intensive programmes to emphasize rapidly developing areas. The flexibility of this structure improves communication between PIMS' members and the larger scientific community, resulting in better trained personnel and establishing vigourous dialogue between the mathematical sciences and the other disciplines.

This section describes the extra-thematic scientific activities of the institute. Each workshop has its own organizing committee and they are mostly held in the various PIMS sites. The selection and funding decisions are made by the Scientific Review Panel.

Fourth Combinatorics Day

University of Lethbridge, May 6, 2004

The organizer for the event was Hadi Kharaghani (University of Lethbridge). Some more information related to the event, including a few photographs, can be found at **http://www.pims.math.ca/combday4.**

This event attracted about 40 participants, about half local, with the rest mainly from universities in Western Canada including Calgary, Alberta, Regina and Manitoba. About a third of the participants were graduate and undergraduate students. The single day event provided a chance for researchers and others with an interest in combinatorics to meet and exchange ideas, and develop collaborative relationships.

The speakers and their lecture titles were:

Richard A. Brualdi (University of Wisconsin - Madison): *Graph Coloring Got Married*

Robert Craigen (University of Manitoba): *Boolean filtering of ternary structures*

Yury Ionin (Central Michigan University): *Generalized Conference Matrices*

Dave Morris (University of Lethbridge): *Hamiltonian cycles in circulant graphs and digraphs*

SAT 2004: The Seventh International Conference on Theory and Applications of Satisfiability Testing

Vancouver, May 10–13 2004

The International Conference on Theory and Applications of Satisfiability Testing is the primary annual meeting for researchers studying the propositional satisfiability problem (SAT), a prominent problem in both theoretical and applied computer science. SAT lies at the heart of the most important open problem in complexity theory (P vs NP), and underlies many applications in artificial intelligence, operations research, and electronic design engineering.

Located in spectacular Vancouver, Canada, SAT 2004 featured technical paper and poster sessions, invited talks, as well as the 2004 SAT Solver Competition and the 2004 QBF Solver Evaluation. The primary objective of the conferences was to bring together researchers from various areas and communities, including artificial intelligence, electronic design engineering, operations research and theoretical computer science to promote collaboration and the communication of new theoretical and practical results in SAT-related research and its industrial applications.

SAT 2004 continued a series of meetings that started with the Workshops on Satisfiability held in Siena, Italy (1996), Paderborn, Germany (1998), and Renesse, The Netherlands (2000); the Workshop on Theory and Applications of Satisfiability Testing held in Boston, USA (2001), the Symposium on Theory and Applications of Satisfiability Testing held in Cincinnati, USA (2002), and the Sixth International Conference on Theory and Applications of Satisfiability Testing held in Santa Margherita Ligure, Italy (2003).

The invited speakers were:

Stephen Cook (University of Toronto): *From Satisfiability to Proof Complexity and Bounded Arithmetic*

Ken McMillan (Cadence Berkeley Labs): *The Behavior of SAT Solvers in Model Checking Application*

Seminar on Stochastic Processes 2004

University of British Columbia, May 20–22, 2004

The Seminar on Stochastic Processes 2004 was held at the University of British Columbia, Vancouver, B.C., Canada, from May 20-22, 2004. As is traditional, there were five invited speakers:

Rene Carmona (Princeton University): *Pricing American Exercises*

Robert Dalang (EPF Lausanne): *Recent results on the stochastic wave equation*

Alice Guionnet (Ecole Normale Superieure de Lyon): *Asymptotics of spherical integrals and matrix models*

Yves Le Jan (Orsay): *Between coalescence and diffusion*

Balint Virag (University of Toronto): *Zeros of I.I.D. Gaussian Power Series*

10th International Workshop on Non-Monotonic Reasoning NMR2004

Whistler, June 6–8, 2004

The 10th workshop in the NMR series was held in June 2004. Its aim was to bring together active researchers in the broad area of nonmonotonic reasoning, including belief revision, reasoning about actions, planning, logic programming, causality, probabilistic and possibilistic approaches to KR, and other related topics. Workshop activities include invited talks, tutorials, presentations of technical papers and special sessions.

Informal proceedings containing accepted papers and other workshop materials will be available on the web at **http://www.pims.math.ca/science/2004/NMR/**

The 2004 Invited Speakers were:

Henry Kyburg: *The Logic of Risky Knowledge*

Jerome Lang: *Logical languages for preference representation (and their relation to nonmonotonic reasoning)*

Mirek Truszcz ynski: *Answer-set programming - directions and challenges*

Analysis, Probability, and Logic: A Conference in Honor of Edward Nelson

University of British Columbia, June 17–18, 2004

On June 17 and 18, 2004 the mathematics department at the University of British Columbia, in conjunction with the Pacific Institute of Mathematical Sciences, hosted a conference to honour the of Edward Nelson, a professor at Princeton University. Dr. Nelson has done influential work in probability, functional analysis, mathematical physics, nonstandard analysis, stochastic mechanics, and logic. This conference was an occasion where his students, colleagues, and friends met to take an overall look at his work and its influence on current research. The experience is intended to be serious, illuminating, and enjoyable.

The programme included review talks on Nelson's research and a few invited talks on current directions in the areas of his interest. It also allocated time for enthusiasts of relevant research areas to have less formal encounters.

Plenary Speakers

Sam Buss (University of California, San Diego): *Ed Nelson's Work in Logic and Foundations*

Eric Carlen (Georgia Institute of Technology): *Mathematical and Physical Problems Suggested by Nelson's Stochastic Mechanics*

Len Gross (Cornell University): *Hypercontractivity, Logarithmic Sobolev Inequalities and Applications: A Survey of Surveys*

Greg Lawler (Cornell University): *Internal Set Theory and Infinitesimal Random Walks*

Barry Simon (California Institute of Technology): *Ed Nelson's Contributions to Quantum Theory*

Cedric Villani (ENS de Lyon): *Current Trends in Optimal Transportation*

These lectures emphasized the different areas in which Ed Nelson worked including logic, stochastic quantum mechanics, mass transport, functional analysis, constructive quantum field theory and nonstandard analysis.

International Conference on Formal Power Series and Algebraic Combinatorics

University of British Columbia, June 28–July 2, 2004

The 16th annual International Conference on Formal Power Series and Algebraic Combinatorics was held at the University of British Columbia from June 28 to July 2, 2005. The topics of this conference were all aspects of combinatorics and their relations with other parts of mathematics, physics, computer science and biology. The invited speakers were:
Norman Biggs, (London School of Economics)
Louis Billera, (Cornell University)
Sara Billey, (University of Washington)
Takayuki Hibi, (Osaka University)
Allen Knutson, (University of California at Berkeley)
Jean-Louis Loday, (Centre National de la Recherche Scientifique)
Robin Pemantle, (Ohio State University)
Anne Schilling, (University of California at Davis)
Gordon Slade, (University of British Columbia)

In addition, June 28 was declared Richard Stanley Day by Vancouver Mayor Larry Campbell.

The following declaration was read by Manfred Trummer (PIMS Deputy Director):

"Whereas Professor Richard Stanley of M.I.T. this month celebrated his sixtieth birthday, this occasion marked by a special conference last week in Boston; and
Whereas Professor Stanley's subject of combinatorics is of increasing importance in information technology and the knowledge economy; and

Whereas, in addition to his important research contributions, Richard Stanley has made an unmatched contribution to the education of young mathematicians, having graduated 38 doctoral students and written a two-volume book which is a standard graduate text in enumerative combinatorics; Whereas many of Richard Stanley's colleagues, former students, and their students are this week gathered in Vancouver for the 16th Annual Conference in Algebraic Combinatorics at UBC; therefore

Today the 28th day of June, 2004 is hereby proclaimed to be Richard Stanley Day in the City of Vancouver."

For more information please see **http://www.pims.math.ca/science/2004/fpsac/**

CECM Day 2004

Simon Fraser University, July 4, 2004

The 2004 CECM one day summer meeting on computational mathematics was held on July 27th in the Halpern centre at SFU. The meeting consisted of five invited talks and a poster session. Roman Nedela spoke on regular maps, Victor Flynn on rational points on curves, Richard Crandall on epizootic waves,Michael Monagan and Allan Wittkopf on new features of Maple release 9.5, and George Labahn on solving linear ODEs with (doubly) periodic coefficients. The following students were awarded poster prizes: Benjamin Ong for his poster on level set methods for adaptive grids, Jennifer de Kleine for the non-monic case of Zippel's GCD algorithm, Mohammad Ali Ebrahimi for his poster on visuals for direction fields in Maple, and Frank Chu for his poster on computations on an Erdös-Turan problem.

Abstracts for talks and posters may be obtained from **http://www.cecm.sfu.ca/events.**

Workshop Computational Arithmetic Geometry

PIMS-SFU, July 5–9, 2004

Organizer: **Nils Bruin** (SFU)

Computational Arithmetic Geometry encompasses the crossroads of geometry and number theory. It is an area that has developed explosively over the last couple of years (Wiles' result on Fermat's last theorem can be viewed as part of it). This workshop concentrated on the application of explicit computations to this area, to solve explicit problems as well as to get insight in the fundamental structures underlying the topic.

The scientific programme consisted of presentations contributed by the participants and lectures by PIMS Distinguished Chair Bjorn Poonen (UC, Berkeley). There were 25 participants and 13 talks over 5 days. The emphasis for events like this is on the opportunities for the participants to communicate and collaborate informally around the scheduled presentations.

For more information see **http://www.cecm.sfu.ca/~nbruin/WCAG2004.**

First Joint Canada-France meeting of the mathematical sciences

Centre de Congrès Toulouse, France, July 12–15, 2004

This was a special joint conference of Canadian and French mathematical societies held July 12-15, 2004 at the Centre de

congrès Pierre Baudis, 11 esplanade Compans Caffarelli, Toulouse, France. It was organized in partnership with the following societies:

La Société Mathématique de France (S.M.F.)
La Société de Mathématiques Appliquées et Industrielles de France (S.M.A.I.)
La Société Française de Statistique (S.F.d.S)
The Canadian Mathematical Society (C.M.S.)
The Statistical Society of Canada (S.S.C.) with the support of The Canadian Applied and Industrial Mathematics Society (C.A.I.M.S.)
L'Institut de Mathématiques de Toulouse (I.M.T.)
Le Ministère de la Jeunesse, de l'Éducation National et de la Recherche (M.J.E.R.)
Le Centre National de la Recherche Scientifique (C.N.R.S.)
L'Université Paul Sabatier (U.P.S.)
La Mairie de Toulouse
Le Centre National d'Etudes Spatiales (C.N.E.S.)
Le Conseil Régional de Midi-Pyrénées
The National Institute for Research in Computer Science and Control (I.N.R.I.A.)

Plenary Speakers were:

Grégoire Allaire (Ec Poly, Palaiseau)
Michèle Artigue (Jussieu)
Maïtine Bergounioux (Orléans)
Jon Borwein (Simon Fraser University)
David Brillinger (University of California, Berkeley)
Alain Connes (Institut des Hautes Etudes Scientifiques)
Walter Craig (McMaster University)
Henri Darmon (McGill University)
Emmanuel Giroux (ENS-Lyon)
Laurent Lafforgue (Institut des Hautes Etudes Scientifiques)
Gabor Lugosi (University of Barcelona)
Mikhail Lyubich (University of Toronto)
Christophe Reutenauer (UQAM)
Alain-Sol Sznitman (ETH Zurich)
Murad Taqqu (Boston University)
Henry Wolkowicz (University of Waterloo)

For more information please see the following website: **http://www.smc.math.ca/Events/Toulouse2004/announce.e**

International Conference on Differential Equations and Applications in Math Biology

Malaspina University College, Nanaimo, BC, July 18–23, 2004

Organizers: **E, Braverman** (University of Calgary), **L. Idels** (Malaspina University College), **L. Berezansky** (Ben-Gurion University, Israel), **A. Ponosov** (Institutt for Matematiske Fag, Norway), **E. Litsyn** (Ben-Gurion University, Israel), **Michael Y. Li** (University of Alberta)

Participants of the International Conference on Differential Equations and Applications in Mathematical Biology at Malaspina University College.

This conference brought together a wide international forum of experts in mathematical biology and ecology, delay, integral, differential and difference equations, population dynamics, consult and optimization, and numerical methods for dynamical systems. The opening ceremonies on July 19, 2004 included greetings on the part of the Malaspina University College and Mathematics Department, the Scientific Committee, PIMS, and the organizing committee. Presentations at the conference covered the topics of modelling infectious age-dependent diseases, industrial applications, population dynamics, including spatial and structured models, especially for marine populations, mathematical modelling in medicine, qualitative theory of functional differential equations. In addition, conference participants were able to experience a guided tour of the Pacific Biological Station at the Department of Fisheries and Oceans and a visit to Cathedral Grove.

The plenary speakers were:

Fred Bauer (University of British Columbia)
Herb Freedman (University of Alberta)
Odo Diekmann (Utrecht University, Netherlands)
Istv'an Gyori (University Veszprem, Hungary)
Thomas Hillen (University of Alberta)
T.A. Burton (Northwest Research Institute)
I.P. Stavroulakis (University of Ioannina, Greece)
J.T. Schnute (Pacific Biological Station, BC)

For more information please see the conference website at **http://web.mala.bc.ca/math/conference**

International Category Theory Conference

University of British Columbia
July 18–24, 2004

Organizer: John MacDonald (University of British Columbia)

There were over 75 participants from 6 continents at the meeting.

The speakers were:

Jiri Adamek (University of Braunschweig): *On the limitations of Birkhoff's (Co)Variety Theorem*
Steve Awodey (Carnegie Mellon University): *Advances in Algebraic Set Theory*
Michael Barr (McGill University): *Perfect Maps: An Exact Category in Topology*
Michael Batanin (Macquarie University): *Lax-Monoids and Configuration Spaces*
Rick Blute (University of Ottawa): *The Shape of Linear Logic*
Dominique Bourn (Universite du Littoral, France): *On the Normal Subobjects in the Category of Topological Groups*
Claudia Centazzo (Louvain-la-Neuve, Belgium): *When does a Functor Realise a Localization of an Algebraic Category?*
Eugenia Cheng (Cambridge University): *n-categories with Duals*
Maria Manuel Clementino (University of Coimbra, Portugal): *Revisiting Cauchy-Completeness*
Robin Cockett (University of Calgary): *The Manifold Construction Revised*
Aurora del Rio Cabeza (University of Granada): *Classification of Equivariant Extensions of Categorical Groups*
Eduardo Dubuc (University of Buenos Aires): *Covering Theory and the Fundamental Progroupoid of a General Topos*
Jeffrey M. Egger (University of Ottawa): *Chu Spaces meet Abstract Homotopy Theory*
Peter Freyd (University of Pennsylvania): *The Core of a Category*
Jonathon Funk (University of Regina): *On a Class of Pullbacks Preserved by the Presheaf Functor*
Emmanuel Galatoulos (University of Athens): *Towards a Categorical Quantum Mechanics*
Nicola Gambino (University of Cambridge): *Generalised Species of Structures and Analytic Functors*
Dale Garraway (Eastern Washington University): *Supremum Enriched Taxons and Sheaves*
Marino Gran (Universite du Littoral, France): *Torsion Theories and Homological Categories*
Marco Grandis (University of Genoa, Italy): *The Shape of a Category up to Directed Homotopy*
Michael J. Healy (University of Washington): *Category Theory and Cognitive Neural Systems: A Mathematical Semantic Model*
Michel Hebert (American University, Cairo): *K-Purity and Orthogonality*
Claudio Hermida (Queen's University): *Fibrations between Fibrations and Logic of Parametric Polymorphism*
David Holgate (University of Stellenbosch, South Africa): *Factorization Systems and (Dis)Connectedness*
Yefim Katsov (Hanover College): *Some Applications of Categorical Algebra in Universal Algebraic Geometry*
Robert E. Kent (Ontologos): *The Information Flow Network (IFF)*
Anders Kock (Aarhus University, Denmark): *Categorical Distribution Theory; Heat Equation*
Juergen Koslowski (Technical University of Braunschweig): *Categorical Transition Systems and Comprehension*
Steve Lack (University of Western Sydney): *Composing PROPs*
F. William Lawvere (University at Buffalo): *Substance and Form of Cohesive Space*
Tom Leinster (University of Glasgow): *Nerves of Algebras*
Fred Linton (Wesleyan University): *The L^p Naturality Gap*
Laszlo Marki (Hungarian Academy of Sciences): *A Simplicial Approach to Factorization Systems and Radicals*
Matias Menni (Lifia/Conicet): *Atomic Toposes of Free Algebras*
Stefan Milius (University of Braunschweig): *Parameterized Iterativity*
Susan Niefield (Union College): *The Geometric Realization of a Simplicial Sheaf on a Space B*
Vaughan Pratt (Stanford University): *Presheaves and Chu Spaces Via the Same 2-Categorical Construction*
Dorette Pronk (Dalhousie University): *Spans, Hammocks, and Fences*
Pedro Resende (Instituto Superior Tecnico Lisboa, Portugal): *Groupoid Quantales*
Diana Ferreira Rodelo (University of the Algarve, Portugal): *Baer Sums in Pointed, Strongly Protomodular and Barr-exact Categories, Level 1 and 2*
Bob Rosebrugh (Mount Allison University): *Split Structures*
Jiri Rosicky (Masaryk University, Czech Republic): *Accessible Quotients and Homotopy*
Vincent Schmitt (University of Leicester): *Parameterized Accessibility*
Christoph Schubert (University of Bremen): *On Partial Morphisms in Categories of Lax Algebras*
Dana Scott (Carnegie Mellon University): *Topology, Categories, and Lambda-Calculus*
Robert Seely (McGill University): *Inner and Outer Adjoints in Polarized Categories*
Lurdes Sousa (Escola Superior de Tecnologia de Viseu): *On Morita Equivalence of Algebraic Theories*
Art Stone (Vancouver): *Two Dimensional Algebra: Can it*

International Category Theory Conference:
Sculpture by John Robinson, http://www.JohnRobinson.com.

help us with (weak) n-dimensional Categories?
Isar Stubbe (Louvain-la-Neuve): *Orders and Ideals over a Base Quantaloid*
Javad Tavakoli (Okanagan University College): *Topology and Small Maps*
Paul Taylor (University of Manchester): *On the Duality between Open and Closed*
Tim Van der Linden (Vrije University, Brussels): *A Model Structure for Homotopy of Internal Categories*
Enrico Vitale (Louvain-la-Neuve): *Descent Theory, Distributive Laws and Yang-Baxter Equation*
Robert Walters (Università dell' Insubria): *Symmetric Separable Algebras in Monoidal Categories and Cospan (Graph)*
Michael Warren (Carnegie Mellon University): *Logical Aspects of the Ideal Completion of a Heyting Pretopos*
R. J. Wood (Dalhousie University): *A Factorization of Regularity*
Joao Xarez (University of Aveiro, Portugal): *Internal Monotone-light Factorization for Categories via Preorders*
Noson Yanofsky (City University of New York): *The Syntax and Semantics of Tannaka Duality*

For more information please see **http://www.pims.math.ca/science/2004/CT04/**

Knots in Vancouver: Workshop in Knot Theory and 3-Manifolds

PIMS UBC, July 19–23, 2004

Organizers: Steve Roger (University of Quebec at Montreal), Roger Fenn (University of Sussex), Dale Rolfsen (UBC), Denis Sjerve (UBC), De Witt Sumners (Florida State University), Peter Zvengrowski (University of Calgary)

The speakers were:

Colin Adams (Williams College): *Surfaces in Hyperbolic Knot Complements*
Stephen Bigelow (UC, Santa Barbara): *Beyond BMW*
David Boyd (UBC): *The A-polynomials of families of symmetric knots*
Nathan Dunfield (Caltech): *Does a random 3-manifold fiber over the circle?*
Stavros Garoufalidis (Georgia Tech): *On the Generalized Hyperbolic Volume Conjecture*
Herman Gluck (University of Pennsylvania): *The Gauss linking integral on the 3-sphere and in hyperbolic 3-space*
Cameron Gordon (U. Texas, Austin): *Knots with unknotting number*
Lou Kauffman (UI Chicago): *Virtual Knot Theory*
Rob Kirby (University of California, San Diego): *Nearly Symplectic 4-Manifolds*
Sergei Matveev (Chelyabinsk State University): *3-manifold recognizer*
Kunio Murasugi (U. Toronto): *Genus of a Montesinos knot and a characterization of fibred Montesinos knots*
Jozef Przytycki (George Washington U): *Khovanov homology: categorification of the Kauffman bracket skein module*
Rachel Roberts (Washington University): *Foliated hyperbolic 3-manifolds containing no R-covered foliation*
Colin Rourke (U. Warwick): *Klyachko, simple homotopy and the second homotopy group*
Lev Rozanski (University of North Carolina): *Matrix factorization and link homology*
Hyam Rubinstein (U. Melbourne): *Approximating the length of minimal Euclidean Steiner trees*
Dev Sinha (U. Oregon): *Homotopy methods in knot theory*
Dan Silver (University of South Alabama): *Applications of Symbolic and Algebraic Dynamics to Knot Theory*
De Witt Sumners (Florida State University): *DNA Topology: Experiments and Analysis*
Peter Teichner (University of California, Berkeley): *Milnor Invariants via Whitney Towers*
Dylan Thurston (Harvard): *How efficiently do 3-manifolds bound 4-manifolds?*
Vladmir Turgev (Strasbourg University): *Virtual Strings*
Susan Williams (University of Southern Alabama): *Applications of Symbolic Algebraic Dynamics to Knot Theory*

For more information please see **http://www.pims.math.ca/science/2004/KT3Mwksp/**

CANQUEUE 2004

Okanagan University College Capri Hotel, Kelowna, BC September 24–25, 2004

Canada's premiere conference in queuing theory is organised by Winfried Grassmann (University of Saskatchewan) and Javad Tavakoli (Okanagan University College).

The CanQueue conference series was initiated by Attahiru S. Alfa from the University of Manitoba, in 1999. The first workshop, in Winnipeg, was followed by workshops in London 2000, Waterloo 2001, Saskatoon 2002 and Toronto 2003. CanQueue is a forum where scientists, researchers, engineers, executives and students in the field meet to encourage ongoing research and to discuss work-in-progress.

Jean C. Walrand (UC, Berkeley) will be the keynote speaker at the 2004 CanQueue Conference. The keynote address will be titled *"Queuing in wireless and high-performance networks"*.

For more information see **http://www.pims.math.ca/science/2004/CanQueue/**.

Pan-American Studies Institute (PASI) 2005

Centro de Modelamiento Matematico, Universidad de Chile, January 10–21, 2005

Organizers: Luis Caffarelli (University of Texas, Austin), Ivar Ekeland (PIMS, UBC), John Mallet-Paret (Brown University), Paul Manasevich (Universidad de Chile), Konstantin Mischai Kow (Georgia Institute of Technology), Yingfei Yi (Georgia Institute of Technology)

The Pan-American Advanced Studies Institute (PASI) on Differential Equations and Nonlinear Analysis was held at the Centro de Modelamiento Matematico, Universidad de Chile, from January 10-21, 2005. This event was a continuation and an extension of the biannual Americas Conference Series on Differential Equations and Nonlinear Analysis, which started in 1994. Since then, this conference has been held five times (in Mexico, Brazil, the United States, Venezuela, and Canada). The main goal of this conference was to promote the interaction between the analytical and dynamical studies of evolutionary equations on the American continent. The core of the program consisted of a series of intensive mini-courses, during the first week, and was followed by complementary lectures, talks, short communications, and discussions on the field's latest develops, during the second week.

The plenary speakers were:

Alfonso Castro (Harvey Mudd College):*Superlinear Boundary Problems*
Shuri New Chow (Georgia Institute of Technology):*Spike Solutions for a Singularly Perturbed Differential Equation Modelling on Electrical Circuit*
Djario de Figueiredo (Universidade Estadulil de Campinas, Brazil):*An Orlicz Approach to Elliptic Systems*
Luca Dieci (Georgia Institute of Technology):*Approximation of Lyapunov and Dichotomy Spectra*
Patricio Felmer (University of Chile):*Critical Exponent an Other Related Questions for the Pucci's Extermal Operatot*
Irene Fonseca (Carnegie Mellon University):*Variational Methods in the Study of Imaging, Foams, Quantum Dots…and more*
Nassif Ghoussoub (PIMS, UBC):*Anti-Selfdual Lagrangians and Variational Resolutions of Non Self-Odfornt Equations and Dissipative Evolutions*
Marty Golybitsky (University of Houston):*Coupled Systems: Theory and Examples*
Celso Grebogi (Universidade de Sao Paulo):*Obstruction to Modelling and Shadowing*
James M. Greenberg (US Office of Naval Research-Global, European Office of Aerospace Research and Development and Carnegie Mellon University:*Congestion Redux*
Barbara Keyfitiz (University of Houston):*Self-Similar Solutions of 2-Dimensional Conversation Laws*
David Kinderlehrer (Careneige Mellon University):*Remarks about Diffusion Mediated Transport*
Yanyan Li (Rutgers University):*On the Yamabe Problem and a Fully Nonlinear Version of It*
Stig-Olof Londen (Helsinki University of Technology): *Quasilinear Evolutionary Equations and Continuous Interpolation Spaces*
Yuan Lou (Ohio State University):*Convergence in Competition Models with Small Diffusion Co-Efficients*
Juan Manfredi (University of Pittsburg):*Convexity from the PDE Point of View*
Hildebrando Munhoz Rodrigues (Universidade de Sao Paulo):*Smooth Linearization in Infinite Dimensional Banach Spaces*
George Sell (University of Minnesota):*Global Climate Modelling and Long time Dynamics*
Michael Sullivan (Southern Illinois University):*Weighted Flow Equivalence of Shifts of Finite Type*

For more information please the conference website at **http://pasi2005.dim.uchile.cl/ndex.php?option=content&task=view&id=9&Itemid=27**

Mathematical Modeling, Implications for Pandemic Influenza Preparedness Workshop

Vancouver, March 30–31, 2005

The key objective of the workshop was to explore the application of modelling techniques to pandemic influenza planning. The workshop was a forum for the mutual exchange of information between the influenza, public health and modeling areas. The potential for modelling to assist the Canadian Pandemic Influenza Committee in designing and prioritizing pandemic influenza preparedness and response strategies will be discussed. In addition, we hope to optimize scientific input into parameters for future models.

A secondary objective of the workshop was to explore the need and interest in an interdisciplinary working group comprised of expertise in: influenza biology; public health and epidemiology; epidemic models, and operations research.

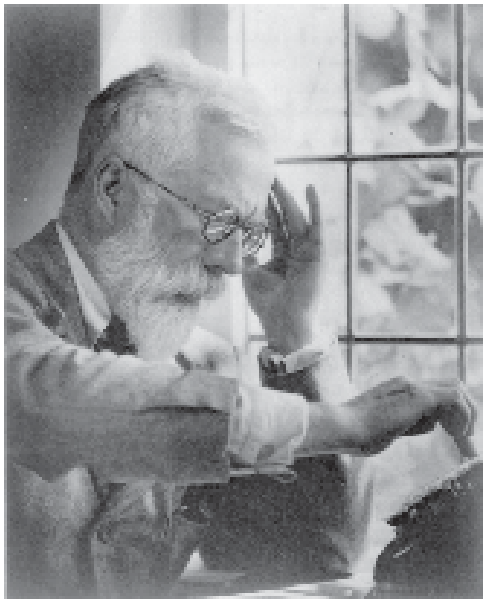
The workshop was sponsored by the Public Health Agency of Canada (PHAC), the British Columbia Centre for Disease Control (BC CDC), the Centre for Excellence in Mathematics: Mathematics of Information Technology and Complex Systems (MITACS) and the Pacific Institute of Mathematical Sciences (PIMS).

For more information see **http://www.mitacs.ca/main.php?mid=10000162&pid=102&eventid=220**

The National Program on Complex Data Structures

The National Program was conceived as a model for a national network in the Statistical Sciences in partnership with Canada's three Mathematical Sciences Institutes. The program was funded by NSERC during the recently completed reallocations exercise and received funding for four years for a total of $687,000 with an additional $200,000 committed to the program by the Institutes. **Jamie Stafford** (U. Toronto) is the Director of the National Program and chairs its Scientific Committee. The Scientific Committee and the Institute Directors are working intensively to establish what is expected to be a very successful program.

The broad goal of the program is to foster nationally coordinated projects with substantial interactions with the large community of scientists involved in analysis of complex data sets, and to establish a framework for national networking of research activities in the statistical community. The original proposal targeted the development and application of statistical methods for the analysis of data obtained from complex survey sample designs and longitudinal biological, epidemiological and medical studies. More specific objectives of the program include the development of collaborations between university and extra-university researchers, and the provision of training for graduate students in important scientific areas through these collaborations.



Fisher, the father of modern statistics.

Jamie Stafford, NPCDS Director.

The working plan for 2003 is to promote collaborative research opportunities in thematic areas through two inaugural workshops/projects. One is in complex survey data analysis for population health and social science, and the other is in statistical genomics/bioinformatics. In partnership with the National Program and Statistics Canada, the project on complex survey data has successfully sought further support from MITACS and has established research positions for students.

The National Program is a unique opportunity to advance the statistical sciences in Canada and its success depends crucially on the active involvement of statisticians and scientists from a variety of sectors across the country. Those interested in providing input on important directions for the program are welcome to do so by contacting Jamie Stafford. Information about the program may be found at the NPCDS link at **www.pims.math.ca/Scientific_Programme/.**

Members of the Programme Committee

Jamie Stafford (Director of the NPCDS, U. Toronto)
David Bellhouse (University of Western Ontario)
Richard Cook (University of Waterloo)
Paul Gustafson (UBC)
Mike Hidiroglou (Statistics Canada)
Nancy Reid (University of Toronto)
Randy Sitter (Simon Fraser University)
Ed Susko (Dalhousie University)
Louis-Paul Rivest (Universite Laval)

Activities 2004/05

NPCDS/SAMSI Workshop on the Design and Analysis of Computer Experiments for Complex Systems

Banff, July 13–17, 2004

Organizers: **Jim Berger** (Duke University SAMSI), **Derek Bingham** (SFU), **Randy Sitter** (SFU), **Jamie Stafford** (University of Toronto, NPCDS), **Will Welch** (UBC)

The National Programme on Complex Data Structures (NPCDS) and the Statistical and Applied Mathematical Sciences Institute (SAMSI) sponsored this four-day workshop that focused on the emerging area of computer experiments. In addition, the Industrial Statistics Laboratory at Simon Fraser University also provided partial funding for this event. The workshop addressed the issues of the design and analysis of experiments for complex computer models, and it aimed to bring together world leaders in the design of experiments and computer simulation of complex systems to study emerging problems in this area.

The workshop's format facilitated interaction among academics, industry researchers, and graduate students and was aimed at addressing three main problems facing experimenters: 1) Factor Screening in High Dimensions, 2) Function Fitting in High Dimensions, and 3) Integration of Physical and Computer Experiments. A combination of lectures, poster presentations, break out sessions, and round table discussions were held over the four-day period. For more information please **see http://www.stat.sfu.ca/%7Edbingham/conference.html**

Workshop on Missing Data Problems

Fields Institute, Toronto, August 5–6, 2004

Organizers: **Richard Cook** (University of Waterloo) and **Don McLeish** (University of Waterloo)

In August of 2004, the NPCDS cosponsored a workshop on Missing Data Problems with the University of Waterloo and GlaxoSmithKline. The workshop was held in Toronto. Modern data often includes some form of censorship or missing data. Data imputation is a critical component of the analysis of such data and crude methods for data imputation can lead to substantial bias in the results and the conclusions. Missing data problems are common in health research (e.g. retrospective and prospective studies), sample surveys (e.g. nonresponsive), and less obvious parts of any study in which the data available is influenced by what is easy or feasible to collect. Longitudinal studies, which collect data on a set of subjects repeatedly over time, are subject to attrition, Subjects drop out because they move, suffer side effects from drugs, or for other often-unknown reasons. Similarly in sampling, survey "nonrespondents" are often ignored, although factors related to the objectives of the study such as income may influence the completeness of a subjects response.

Problems which involved missing data have historically been dealt with using a "complete-case analysis'' which ignores the missing data and therefore biases conclusions. There have been many new computationally intensive tools developed in recent years which can be applied to these problems: likelihood and estimating function methodology, cross-

validation, the bootstrap and other simulation techniques, Bayes' and multiple imputation, and the EM algorithm.

This two-day workshop consisted of a series of lectures focused on the development of mathematical and statistical tools for the analysis of data under various patterns of censorship and mechanisms governing messiness and data imputation. Audio recordings of the lectures given are available on-line at **http://www.fields.utoronto.ca/audio/04-05/#missing-data**

Plenary speakers included:

Shelley Bull (University of Toronto): *Missing Data in Family-Based Genetic Association Studies*
Nilanjan Chatterjee (NIH): *Missing Data Problems in Statistical Genetics*
Jinbo Chen (NIH): *Semiparametric Efficiency and Optimal Estimation For Missing Data Problems with Application to Auxiliary Outcomes*
Richard Cook (University of Waterloo): *Weighted Generalized Estimating Equations for Uncomputable Clustered Longitudial Data*
Roderick Little (University of Michigan): *Robust Likelihood-Based Analysis of Multivariate Data with Missing Values*
Don McLeish (University of Waterloo): *Regression with Missing Covariates: Importance Sampling and Imputation*
Andrea Rotnitzky (Harvard University): *Doubly-Robust Estimation of the Area Under the Operating Characteristics Curve in the Presence of Non-Ignorable Verification Bias*
Donald Rubin (Harvard University): *Multiple Imputation for Item Nonresponse: Some Current Theory and Application to Anthrax Vaccine Experiments at CDC*
Daniel Sharfstein (John Hopkins University): *Sensitivity, Analysis for Informatively Interval Censored Discrete Time to Event Data*
Alastair Scott (University of Auckland): *Fitting Family Specific Models to Retrospective Family Data*
Mary Thompson (University of Waterloo): *Interval Censoring of Event Times in the National Population Health Survey*
Chris Wild (University of Auckland): *Some Issues of Efficiency and Robustness*
Grace Yi (University of Waterloo): *Median Regression Models for Longitudinal Data with Missing Observation*

Workshop on Data Mining Methodology and Applications

The Fields Institute, Toronto, ON
October 28–30, 2004

Organizers: **Hugh Chipman** (Acadia University), **Antonio Ciampi** (McGill University), **Michael Vainder** (Generation 5)

Data mining is a new and fast-changing discipline, which aims to discover unusual and unexpected patterns in large volumes of data. Data mining borrow from several long-established disciplines, among them, data base technology, machine learning, and statistics. This workshop focused on the interplay of statistics and data mining. Statistical learning theory provides the foundation for learning from data in the presence of uncertainty. At the same time, typical problems of data mining spur statistical research into new directions.

The workshop contained a mix of sessions on both data mining methodology and real-world applications and problems. Participants and speakers included both academics and practical data miners. The workshop was conducted in a format that included lectures, panel discussions, and open discussions.

Plenary speakers included:

David Banks (Duke University, SAMSI): *Scalability of Models in Data Mining*
Yoshua Bengio (Universite de Montreal): *Statistical Learning from High Dimensional and Complex Data: Not a Lost Cause*
Jerome Friedman (Stanford University): *Importance Sampling: An Alternative View of Ensemble Learning*
Grigoris Karakoulas (University of Toronto): *Roc-Based Learning for Imbalanced Class Problems*
Helmut Kroeger (Universite de Laval): *Learning in Neutral Networks with Small-World Architecture*
Joaquin Ordieres Mere (Universidad de la Rioja): *Data-Mining for Industrial Processes*
Russell Steele (McGill University): *Algebraic Geometry and Model Selection for Naive Bayes Networks*
Steven Wang (York University): *Clustering Categorical Data Based on Distance Vectors*
Stan Young (SAMSI):*Linking and Pattern Matching in Multiple Large Data Two-Way Tables*
Reuben Zamar (UBC): *Robust Methods and Data Mining*
Ji Zhu (University of Michigan): *In Regularization: Efficient and Effect Priecewise Linear SVM Paths*
Mu Zhu (University of Waterloo): *An Adaptive Radial Basis Function Network Model for Statistical Detection*

Atlantic Association for Research in the Mathematical Sciences

The Atlantic Association for Research in the Mathematical Sciences (AARMS) was founded in 1995 at a time when the National Network for Research in the Mathematical Sciences was being discussed and planned. AARMS exists to encourage and advance research in all mathematical sciences, including statistics and computer science, in the Atlantic region. In addition, AARMS acts as a regional voice in discussions of the mathematical sciences on a national level. Since its inception, AARMS has played an important role in the research activities in the Atlantic region, sponsoring or co-sponsoring numerous meetings and workshops. In the summer of 2002, AARMS initiated an annual Summer School for graduate students and promising undergraduates. Please write to us for information about the next AARMS Summer School.

AARMS activities are funded by Canada's three mathematical institutes, the Fields Institute, the Centre de Recherches Mathématiques, and the Pacific Institute for Research in the Mathematical Sciences as well as Acadia University, Dalhousie University, Memorial University, and the University of New Brunswick (Fredericton).

For further information please see the AARMS link at **www.pims.math.ca/Scientific_Programme/.**

AARMS Scientific Review Panel

The AARMS Scientific Review Panel members are:

Barbara Keyfitz (Director, The Fields Institute for Research in Mathematical Sciences)
Paul Cabilio (Acadia University)
Kenneth R. Davidson (University of Waterloo)
Ivar Ekeland (Director, PIMS)
Uri Ascher (University of British Columbia)
Eric Aubanel (University of New Brunswick)
Yuri Bahturin (Memorial University of Newfoundland)
Margaret Beattie (Mount Allison University)
Richard Charron (Guigne International)
John Clements (Dalhousie University)
Nassif Ghoussoub (University of British Columbia)
Lisa Jeffrey (University of Toronto)
Dan Kucerovsky (University of New Brunswick)
Francois Lalonde (CRC, Université de Montréal)
Bruce Smith (Dalhousie University
Catherine Sulem (University of Toronto)
Mary Williams (Director General, NRC Institute for Marine Dynamics)
Jianhong Wu (CRC, York University)



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

Activities 2004/05:

International Workshop on Wavelets-Theory and Applications
University of Prince Edward Island,
April 26– May 7, 2004

Organizer: **Nasser Saad** (University of Prince Edward Island)

AARMS-CRM Workshop on Singular Integrals and CR Manifolds
Dalhousie University,
May 3–8, 2004

Organizers: **Galia Dafni** (Concordia University), **Andrea Fraser** (Dalhousie University)

31st Annual Canadian Operator Theory and Operator Algebra Symposium
University of New Brunswick, Fredericton,
May 20–24, 2003

Organizer: **Dan Kucerovsky** (University of New Brunswick)

Fifth Annual Bluenose Numerical Analysis Day
Acadia University,
May 28, 2004

Organizers: **Richard Karsten** (Holger), **Keith Taylor** (Dalhousie University), **Paul Muir** (Saint Mary's University), **Ray Spiteri** (Dalhousie University)

Summer Meeting of CMS: Symposia Supported by AARMS
Dalhousie University,
June 13–15, 2004

Organizers: **Keith Johnson** (Dalhousie University), **Renzo Piccinini** (University of Milan)

AARMS Workshop on Symbolic Computation
Dalhousie University,
June 16, 2004

Organizers: **Robert Milson** (Dalhousie University), **Alan Coley** (Dalhousie University), **M. Fels** (Utah State University)

International Conference on Nielsen Theory and Related Topics
Memorial University of Newfoundland,
June 28–July 2, 2004

Organizers: **Philip Heath** (Memorial University), **Edward Keppelmann** (University of Nevada)

International Conference on Nonlinear Dynamics and Evolution Equations
Memorial University of Newfoundland,
July 6–10, 2004

Organizers: **Xiaoqiang Zhao** (Memorial University), **Xingfu Zou** (Memorial University), **Andy Foster** (Memorial University), **Yuan Yuan** (Memorial University), **Brian Sleeman** (Leeds University), **Jianhong Wu** (York University)

2004 AARMS Summer School
Memorial University of Newfoundland,
July 12–August 16, 2004

Organizer: **Dr. Edgar Goodaire** (Memorial University)

Workshop on Combinatorial Designs and Related Topics
Memorial University,
July 14–18, 2003

Organizers: **Rolf Rees** and **Nabil Shalaby** (Memorial University)

APICS 2004: AARMS Symposium on Functional Analysis and Operator Algebra

University of New Brunswick at Saint John, October 17, 2004

Organizers: **Dan Kucerovsky** (University of New Brunswick), **Andrew Toms** (University of New Brunswick)

East Coast Combinatorics Conference 2005

University of New Brunswick, January 22, 2005

Organizers: **Hugh Tomas** (Mathematics) and **David Bremner** (Computer Science) (University of New Brunswick)

IV. INDUSTRIAL PROGRAMME

Students mingling at the 2004 PIMS-MITACS Industrial Problem Solving Workshop, which took place at the University of British Columbia, May 17–21, 2004.

Jack Macki at the 2004 PIMS-MITACS Industrial Problem Solving Workshop, which took place at the University of British Columbia, May 17–21, 2004.

PIMS/MITACS Industrial Partners:

Advanis
Amber Computer Systems
APPEGA
Ballard Power Systems Inc.
Barrodale Computing
Bayer Inc.
BC Cancer Research Center
BC Hydro
BioTools
Canadian Cable Labs
Canadian Marconi
Charles Howards & Associates
Chemex Labs
Computer Modeling Group
Corel Corporation
Crystar Research Inc.
Diagnostic Engineering Inc.
Dynapro
Eastman Kodak
Enbridge
FinancialCAD Corporation
Firebird Semiconductors
Galdos Systems
Hughes Aircraft
Husky Oil
IBM T. J. Watson Research Center
ICBC
Imperial Oil
In Silico
Insightful
Itres Research Ltd.
Kinetek Pharmaceuticals Inc.
Lockheed Martin Tactical Defense Systems
Math Resources Inc.
MathSoft
MacMillan Bloedel Ltd.
McMillan-McGee
MDSI
Menex Technologies
Merak
Michelin
NALCO Canada Inc.
NORTEL Networks
Novacor
Pacific Forestry Centre
PanCanadian Petroleum Ltd.
Petro Canada
Progas
Powerex
Powertech Labs Inc.
Precision Biochemicals
Prestige Telecommunications
Progas
Quatronix Media
Searle
Shaw Cable
Siemens Research
Simons International Copr.
SmithKline BeeCham Pharma
Sperry-Sun
Soundlogic
StemCell Technologies Inc.
StemSoft Software Inc.
Stentor
Stern Stewart & Co.
Sun Microsystems
Syncrude
Telecom Research Labs
Telus
TransAlta
Veritas DGC
VisionSmart
Vortek Industries Ltd.
Waterloo Maple Inc.
Worker's Compensation Board

Industrial Problem Solving Programme

The format of the **Industrial Problem Solving Workshops** is mainly based on the Oxford Study Group Model, in which problems of relevant and current interest to the participating companies are posed to the workshop participants by experts from industry. The participating graduate students and academics will spend five days working on the problems and the results will be published in the workshop's proceedings. 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.
- Help PIMS and mathematics in general, by showing businesses and governments the tangible benefits of supporting the mathematical sciences.

MITACS

8th PIMS-MITACS Industrial Problem Solving Workshop

University of British Columbia, May 17–21, 2004

Organizers:

Rex Westbrook (University of Calgary)
Kes Salkauskas (University of Calgary)

Academic Experts

Petra Berenbunk (Simon Fraser University)
C. Sean Bohun (Penn State University)
Ian Frigaard (University of British Columbia)
Huaxiong Huang (York University)
Michael Lamoureux (University of Calgary)
Tim Myers (University of Cape Town)
Nilima Nigam (McGill University)
Anthony Peirce (University of British Columbia)
Randall Pyke (University College of the Fraser Valley, Abbotsford, BC)
Tobias Schaefer (University of North Carolina at Chapel Hill)
John Stockie (Simon Fraser University)
Brian Wetton (University of British Columbia)

Industrial Participants:

Husky Injection Molding Systems
Random Knowledge
Michelin Tire
Husky Energy
Powertech Labs

The 8th Annual Industrial Problem Solving Workshop, this year sponsored by PIMS and MITACS, came to a successful conclusion at the University of British Columbia on Friday, May 21. For the previous four days the group of approximately 80 academics and graduate students had worked on four industrial problems.

Surrey Kim (Random Knowledge Inc., Edmonton, AB, Canada): *How's the Traffic?*

Surrey Kim brought a problem relating to network security. Current methods for detecting malicious hacker activity are still in their infancy. Today's methods lack accuracy, speed, and reliability. The approach taken here is to detect malicious activity by identifying anomalous behaviour in otherwise normal network traffic flow. The first task in this problem is to find a mathematical model for normal (legitimate) traffic. In this workshop the group investigated whether normal traffic can be modelled by piece-wis homogeneous Poisson processes.

John Ceko (Husky Injection Molding Systems, Bolton, ON, Canada): *The Effects of Impact on Design Features*

Husky was interested in finding a simplified model of the focus involved in an injection molding machine. In normal operation the piston screw, travelling at a prescribed velocity, impacts molten metal that has been injected into the mold and forces it to completely fill the mold. Therefore, design features must be specified so that the machine can withstand the repeated stress on the piston due to its impact with the molten metal. In addition, in the event that there is an insufficient amount of material in the mold, the piston may "bottom out". That is, the flange of the piston may impact the housing at full velocity. Currently, the company's analysis of the "bottom out" problem assures a dry contact between the impacting bodies that will significantly reduce the stress on the system.

A preliminary model which couples the height of the squeeze film with the pressure inside the mold was derived. This provided some information regarding the extent of the stress reduction due to the lubricant. Based on these preliminary results, an improved model that incorporates the hydraulic fluid, the leakage of molten metal past the screw tip and the compressibility of the machine parts and the molten metal is currently being developed.

Kenneth Hedlin (Husky Energy, Calgary, AB, Canada): *Seismic Attentuation Problem*

The problem presented by Husky Energy concerned seismic attenuation. As an exploration toll attenuation effects have only recently attracted attention. These effects prove useful in two ways: as a means of correcting seismic data to enhance resolution of standard imaging techniques, and as a direct hydrocarbon indicator. In this workshop, attenuation effects, such as spherical divergence or scattering were ignored and work was focused on intrinsic attenuation effects exclusively. The goal of the workshop was to find a means of computing seismic attenuation from relatively short windows of seismic imaging data, and particularly be able to identify regions of anomalous attenuation.

During the course of the workshop, the team learned of several techniques currently being used and studied some other possibilities. In detail:

i) An investigation was made of the utility and robustness of using the centroidal frequency and second moment of the frequency over a windowed seismic trace as predictors of anomalous attenuation.

ii) Wavelet-based techniques were used to remove reflectively information from the trace and subsequently extract attenuation information.

iii) The Wiener technique was extended to the case with attenuation.

In addition to pursuing numerical implementations of the latter two methods, future work regarding this problem will investigate the use of statistical and linear algebraic techniques to retrieve information about attenuation anomalies.

Bill Mawby (Michelin Tire Corp., Greenville, SC, USA): *Statistical Design of an Experimental Problem in Heumonics*

Bill Mawby returned with a follow up on a problem discussed four years ago. Then the Michelin Tire Corporation proposed a problem on experimental design, to improve the manufacturing process for their tires. The idea is basically to determine the effect of placements for various layers built up in the construction of a tire, to allow the design of a smooth tire with a smooth ride. A highly successful solution was developed, and it has been reported that this method introduced savings of over half a million dollars in their test processes.

This year, Michelin returned to the workshop with an extension to the original problem to address specific refinements in the testing method. The new problem for 2004 was to extend the previous PIMS IPSW 2000 results on Statistical Design in any of several directions including:

i) Developing fully the method called the Good Lattice Points (GLP), a method suggested in 2000 so that it could be implemented in practice to allow estimation without the prime number restriction.

ii) Providing an optimal design strategy given a priori a number of non-harmonic frequency effects and possible ranges for their frequencies.

iii) Investigating the ramifications of measuring several different waveforms. For example, one measured radially and one measured perpendicular to the tread.

iv) Expansion of the concept to a two-dimensional Fourier transform or equivalent where the surface could be consid-

ered flat or as the surface of an inflated tire (semi-toroidal).

By extending the linear Fourier model developed at the IPSW in 2000, the group was able to make remarkable progress on the four problems, essentially resolving the first three, and suggesting a promising direction to resolve the fourth problem.

For more information please see **www.pims.math.ca/industrial/2004/ipsw/**.

At the 2004 PIMS-MITACS Industrial Problem Solving Workshop. The University of British Columbia May 17-21, 2004

Industrial and Scientific Training Activities

Basic Components of Programme:

The PIMS Graduate Industrial Mathematics Modeling Camp: Graduate students from Canadian universities come 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).

The Industrial Workshops and Mini-courses with topics of interest to both industry and academia serve to disseminate newly developed mathematical tools that can be of use in industry. The workshops are more interactive than the mini-courses.

The PIMS Mathematical Biology Summer Workshop introduces undergraduate students to mathematical modelling and analysis applied to real biological systems.

The Frontiers of Mathematical Physics Summer School: This annual summer school is jointly sponsored by PIMS, Asia Pacific Center for Theoretical Physics, the Perimeter Institute for Theoretical Physics, with additional support by TRIUMF. It is intended to educate graduate students and young researchers about current developments in string theory.

Mathematics of Biological Systems: 3rd Annual PIMS Mathematical Biology Summer Workshop

University of Alberta, May 4–14, 2004

Organizer: **Kym Schreiner** (U. Alberta)

The Centre for Mathematical Biology (CMB), University of Alberta, hosted its 3rd Annual PIMS Mathematical Biology Summer Workshop entitled "Mathematics of Biological Systems" from May 4-14, 2004. The aim of this 11-day workshop was to introduce undergraduate students to mathematical modelling and analysis applied to real biological systems. Instructors were Gerda de Vries, Thomas Hillen (both from the University of Alberta), Frithjof Lutscher (PIMS postdoctoral fellow from the universities of Alberta and Calgary), and Gary de Young (King's University College), plus guest instructor Leah Edelstein-Keshet (University of British Columbia). There was further assistance provided by volunteer postdoctoral fellows, staff, and graduate students.

Instructors for the 3rd Annual PIMS Mathematical Biology Summer Workshop for Undergraduates. From Left: Frithjof Lutscher (PIMS postdoctoral fellow at U. Alberta and U. Calgary), Prof. Gerda de Vries, Prof. Mark Lewis, Prof. Thomas Hillen (all from U. Alberta), Prof. Gary de Young (King's University College), Prof. Leah Edelstein-Keshet (UBC) and Alex Potapov (Research Associate U. Alberta and U. Notre Dame).

In total, 16 students from 12 different universities across Canada and the United States participated in the workshop. More than half of the attendees were women. The 11-day workshop was split into three major parts. In part one the instructors gave a series of classroom lectures and exercise labs. In part two students worked throu a self-guided Maple course. In part three students paired up to work on a chosen modelling project work, which was presented at the end of the workshop. Through each part of the workshop there was strong guidance provided by the main instructors, the guest lectur-

ers, and volunteer PDFs and graduate students.

The students' responses to this workshop were very positive and a follow up survey revealed that many of the participants heard about the workshop from last year's attendees. The exchange of ideas and knowledge that occurred between students clearly carried back to their home universities. One student responded by saying *"This workshop exposed me to some of the techniques involved in the study of biological systems, and reinforced my interests of such study. I have met some really interesting people and have been able to transform my summer research in a math bio project...thanks to all involved in the preparation, organization, and funding of the Math Bio Workshop 2004. It was a great experience!"*

PIMS-MITACS Summer School in Probability

University of British Columbia, May 25–June 25, 2004

Organizers: **Martin Barlow** (UBC) and **Gregory Lawler** (UBC)

The first ever PIMS-MITACS Summer School in Probability was held at UBC from May 25–June 25, 2004. The summer school operated over a 5-week period in which participants attended two graduate level courses. Dr. Martin Barlow (UBC) and Dr Greg Lawler (Cornell University) gave the lectures. Dr. Barlow's course was entitled *Random Walks and the Geometry of Graphs* and dealt with theories and ideas of the interactions between geometric properties of graphs, and the behaviour of random walks, transition densities, and harmonic functions. Dr. Lawler's lecture, on *Schramm-Loewner Evolution (SLE) and Other Conformally Invariant Processes in the Plane*, discussed the mathematics of the scaling limits of lattice systems in statistical physics.

7th PIMS-MITACS Graduate Industrial Math Modelling Camp

University of Victoria, May 10–14, 2004

Organizers: **Rex Westbrook** (U. Calgary), **Kes Salkauskas** (U. Calgary), **David Leeming** (U. Victoria), **Reinhard Illner** (U. Victoria), **Pauline van den Driessche** (U. Victoria), **Julie Zhou** (U. Victoria)

The Graduate Mathematics Modelling Camp (GMMC) is the first leg of the PIMS-MITACS Industrial Mathematics Forum, which also includes the PIMS-MITACS Industrial Problem Solving Workshop (IPSW 8). The GMMC is designed to give graduate students in the mathematical sciences an opportunity to learn techniques of mathematical modelling under the supervision and guidance of experts in the field. The camp is designed so that the mentors present the problems at the beginning of the week and then the students spend the rest of the week working on these problems with the assistance of the mentor. The culminating result was a series of group presentations and written documents.

The 2004 mentors and problems were:

C. Sean Bohun (Penn State University): *Optimal Design of Gas Burst Gene Gun*

Tim Myers (University of Cape Town): *Modelling the Temperature Distribute in Concrete Structure*

Tobias Schaefer (University of North Carolina, Chapel Hill): *Modelling Nonlinear Pulse Propagation in Optical Transmission Lines*

Petra Berenbrink (Simon Fraser University): *Modelling the Growth of the Internet*

Randall Pyke (University College of the Fraser Valley, Abbotsford, BC): *Path Planning for an Autonomous Robot*

Peter Ehlers (University of Calgary): *Assessment of Storm water Concentration Data*

PIMS-MITACS Minicourse in Mathematical Finance

PIMS-UBC, June 14–18, 2004

Organziers: **Nizar Touzi** (CREST, Laboratoire de Finance et Assurance)

From June 14–18, 2004, PIMS and MITACS co-sponsored a mini course in Mathematical Finace at PIMS-UBC. The course was designed as a series of eight lectures given by Dr. Nizar Touzi. The lectures, entitled *Superhedging Under Portfolio Constraints-a Singular Stochastic Control Problem,* dealt with non-standard stochastic control problems and its relationships to problems in finance. For more information please see the website at **http://www.pims.math.ca/industrial/2004/minifin/**.

MSRI-PIMS Summer Graduate Programme: Knots and 3-Manifolds

UBC, July 7–20, 2004

Organizers: **S. Boyer** (UQAM), **R. Fenn** (Sussex), **D. Rolfsen** (UBC), **D. Sjerve** (UBC)

Please see page 36 for a full report.

Frontiers of Mathematical Physics—Summer School on Strings, Gravity and Cosmology

PIMS-UBC, August 3–13, 2004

Organizers: **Taejin Lee** (APCTP), **John Ng** (TRIUMF, UBC), **Moshe Rozali** (UBC), **Alexander Rutherford** (PIMS) and **Gordon W. Semenoff** (UBC)

Please see page 37 for a full report.

MITACS: A Network of Centers of Excellence for the Mathematical Sciences

Mathematics of Information Technology and Complex Systems (MITACS) is one of the three Networks of Centers of Excellence (NCE) created in 1998. The MITACS NCE is a joint venture of the three Canadian mathematical sciences institutes: the Centre de Recherches Mathématiques, the Fields Institute for research in Mathematical Sciences and the Pacific Institute for the Mathematical Sciences. MITACS harnesses mathematical power for the benefit of the Canadian economy. The network brings together more than 150 researchers at 22 Canadian universities with more than 70 Canadian industrial, medical, and financial organizations. The network comprises 23 projects addressing problems in five sectors of the Canadian economy, including two new projects funded in 2000.

The creation of the MITACS network provides an exceptional opportunity for the mathematical sciences community to develop a large scale systematic programme for research, HQP training and the development of partnerships with key business, industrial and health care sectors across the country.

Arvind Gupta, MITACS Chief Executive Officer/Scientific Director.

MITACS 5th Annual Conference, Dalhousie University, Halifax, June 9-12, 2004

For more information see www.mitacs.math.ca/AC2004/.

Top Ten Student Award Winners at the MITACS 5th Annual Conference.

Naveen Vaidya, former Intern on the Firebird Technologies project explains his research to Arvind Gupta, MITACS Scientific Director.

MITACS Projects at PIMS

The MITACS Administrator for PIMS-UBC is Clarina Chan.

PIMS Administers the following MITACS projects through its UBC/Central Office.

Biomedical Models of Cellular and Physiological Systems in Health and Disease

Project Leader: **Leah Keshet** (University of British Columbia)

Mathematical Modeling and Scientific Computation

Project Leader: **Brian Wetton** (University of British Columbia)

PIMS Administers the UBC researchers involved in the following project:

Modelling Trading and Risk in the Market

Antony Ware (University of Calgary)

For the full list of MITACS projects see **http://www.mitacs.ca/main.php?mid=10000005&pid=115**.

PIMS Affiliated MITACS Postdoctoral Fellows 2004

Dr. Paul Chang, University of British Columbia
Dr. Ronald Ferguson, Simon Fraser University/University of British Columbia
Dr. Hugh Geiger, University of Calgary

V. MATHEMATICS EDUCATION PROGRAMME

Students participating in Math Mania.

Scott Hegardoren, the Senior Contest winner of the 31st BC Colleges High School Mathematics Contest, celebrates his win with Frank Ruskey (University of Victoria), and Shane Rollans (UCC).

Students participating in MathCircles.

The 2004 Grade Five Winners of the PIMS Elementary Grades Mathematics Contest (ELMACON).

Initiatives for K–12 Students

PIMS is continues to provide fun and innovative education activities for elementary and high school students. These include mathematics competitions and math fairs.

Activities for Elementary Schools

The following activities took place for elementary school students in 2004/05.

Math Mania

Math Mania is part of PIMS "Alternative Math Education" programme where Faculty and Staff from the PIMS Universities present "fun" methods for teaching math and computer science to children (and adults!) using games and art. It takes place at elementary schools in Victoria, BC. Typically included in the presentations are soap bubble demonstrations, constellations as 2D networks, geometry and paper, the Set Game, a binomial probability experiment using pennies, and exciting geometrical models from straws and paper. Other demonstrations involve chess games, parallel algorithms of network sorts, and recursive methods in mathematical puzzles. These events attract around 300 students and parents each evening. In addition, the success of Math Mania is also due the support it receives from enthusiastic volunteers, whose hard work contributes to the excellence of this program.

David Leeming (U. Victoria), Math Mania organizer.

The Math Mania events in 2004/05 were:

May 24, 2004: Lake Hill Elementary School, Victoria, BC
October 26, 2004: St. Margaret's Private School, Victoria, BC
February 8, 2005: Colwood Elementary School, Victoria, BC

MathClick Workshops

MathClick workshops are full-day mathematics immersions experiential events for students in grades 5- 7. They are not only for the mathematically talented; in fact, the main intention is to awaken children's latent talent and interest by showing them that mathematics can be also playful and intriguing. Students in these workshops engaged in a genuine mathematical inquiry in a very encouraging environment that promoted a feeling of surprise and ample opportunity for success. Klaus Hoechsmann (PIMS Education Facilitator) and one of the workshop instructors coauthored the mathematical content for the workshop programme.

Student building a kite at a MathClick workshop.

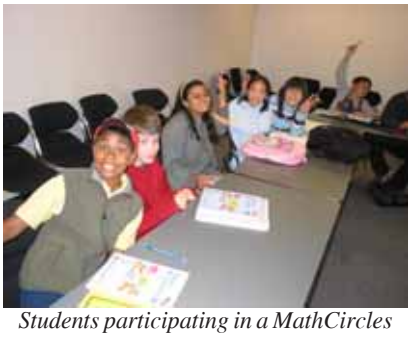
The workshops were taught by Edel Vo and Natasa Sirotic from Collingwood School and assisted by Wendy Dorn from the Burnable School District. The 2004 MathClick workshop took place on August 24. The students all went home with certificates of participation.

Judy Dalling, the parent of 2001 MathClick participant Eleanora, attests that this single-day workshop can be truly transformational and can dazzle a child to the extent of completely reconditioning her or him for success in mathematics. She wrote, "*Last August I enrolled my 10 year-old daughter Eleanora in the one day MathClick workshop. Her record at elementary school was poor in all areas. In Grade 5 math, social science she had a C average, and getting her to complete assignments was impossible. After taking the MathClick workshop her attitude completely changed. She realized that*

she was capable of much greater things. She has not missed one day of school this year, and she has replaced the Cs on her report card with As. When asked, Eleanora credits these changes to your encouragement in the workshop. Thank you for helping her realize her potential. What a difference a day can make!

Math Circles

The Math Circles Coaching Programme is a follow-up to the MathClick workshops. MathCircles took place for 1.5 hours on Saturdays over 17 weeks in fall 2004 and winter 2005 and is based on the Singapore Grade 6 programme with modifications. It is intended for all grade 5 8 students. Its goal is to ensure that the students develop mathematical competence by "learning new math" and "practicing the math they've learned". One student commented, "*Math is fun. It's like there's a party in my brain. Math pumps up your brain to make you smart*".



Students participating in a MathCircles workshop

Activities with High School Students

The PIMS education panel organizes a number of events aimed at high school students. Here we describe one such event. The two sections that follow this one, Mathematics Competitions and PIMS Math Fair Programme, highlight many other PIMS activities for high school students.

Summer Institute for Mathematics for High School Students

University of Washington, June 28– August 3, 2004

Students taking part in the Summer Institute for Mathematics

Getting a glimpse of the depth and beauty of mathematics can be a transforming experience for a student, whatever interests the student may intend to pursue in the future. The Summer Institute for Mathematics at the University of Washington (SIMUW) is intended to provide talented, enthusiastic students with just such a glimpse. Admission into the SIMUW programme is competitive, based on an assessment both of ability in mathematics and enthusiasm for an intensive mathematical experience.

The SIMUW 2004 programme brought together twenty-four students from Washington, British Columbia, Oregon, Idaho, and Alaska. The students had a background of at least three years of high school mathematics but had not yet completed high school. Admission was competitive, based on an assessment both of ability in mathematics and enthusiasm for an intensive mathematical experience. Many students stayed in UW residence halls.

The SIMUW programme was organized by four UW faculty members: Ron Irving, Sándor Kovács, James Morrow, and Paul LePore. Six mathematicians from UW, Microsoft, and the University of Chicago served as the instructors. In addition, another eight mathematicians and scientists from UW and elsewhere participated as special lecturers.

The programme was divided into two-week blocks, with two instructors for each block. During four of the five weekdays of each week, the students met with one of the instructors in a morning session and the other instructor in an afternoon session. During these sessions, students grappled with mathematical problems that are designed to be challenging yet ultimately accessible. The instructors lectured to a limited extent, in order to provide necessary background, but the emphasis was on giving the students the opportunity to tackle hard mathematical problems in collaboration with the staff.

A special programme was arranged for the remaining weekday of each week. In the morning, a speaker from the campus or the region discussed the role mathematics plays in his or her work. The afternoon session either featured a second speaker or consisted of a special activity or field trip related to mathematics. For more information please see **http://www.math.washington.edu/~simuw/**.

Throwing boomerangs: Pi in the Sky.

The 2004 SIMUW lectures were:

Monty McGovern (University of Washington): *Mathematical Reasoning and Proofs*
David Collingwood (University of Washington): *Symmetry*
Judith Arms (University of Washington): *The Mathematical Theory of Knots*
Nathan Kutz (University of Washington): *Mathematical Biology*
Robert Pollack (Boston University): *Elliptic Curves - a mix of algebra and geometry*
Henry Cohn (Microsoft Research): *Combinatorics*
Zack Treisman (University of Washington): *Images of Hyperbolic Geometry*
Chuck Doran (University of Washington): *String Theory and Mathematics*
Sara Billey (MIT): *Zometool Competition*
Peter Hoff (University of Washington): *The Great and Powerful Markov Chain Monte Carlo Algorithm*
Angela Gibney (University of Pennsylvania): *The Mathematics of the Artwork of M.C. Escher*
Carl Bergstrom (University of Washington): *Game Theory with more than two players: auctions and two-sided matching games*
Ernie Esser (University of California at Los Angeles): *What Makes Boomerangs Come Back*

Mathematics Competitions

Traditionally, mathematics skill and interest can be uncovered in students by exposure to challenging mathematical exams and contests. PIMS sponsors Alberta and BC participation in a number of such national and international competitions.

CMS Regional Math Camps

To identify and nurture future members of the Canadian team for the International Mathematical Olympiad, the CMS, Esso and PIMS sponsor this yearly event to which students in grades 8–10, as well as exceptional elementary grade students, are invited based on merit. Topics in Combinatorics, Number Theory, Algebra and Geometry are covered at the difficulty level of the Olympiad. This is part of a long-range goal of the CMS to develop mathematical talent in Canadian students to compete on the world stage.

2004 ESS0-CMS-PIMS Math Camp

SFU, June 21–25, 2004

The 2004 ESSO - CMS - PIMS Math Camp for High School students took place Monday, June 21st to Friday, June 25th, at the SFU Burnaby campus. This was the fourth time SFU hosted the camp, which was organized this year by Veselin Jungic, Justin Gray and Malgorzata Dubiel, Department of Mathematics, Simon Fraser University.

Teachers selected thirty-four grade 9 and 10 students from 18 Lower Mainland schools from over sixty applications send. For five days, these exceptional students participated in exciting and challenging activities, and problem sessions. The SFU faculty and graduate students presented these activities, and two invited speakers, Dr. Branko Curgus from Western Washington University and Dr. Rob Scharein, CECM/WestGrid/NewMIC. The schedule of camp activities is included below. Several problem sessions and challenge problems given every day culminated in a contest written Friday morning. And, since the quality and the enthusiasm of the participants were extremely high, everybody left with a prize - and some with more than one!

For the duration of the camp, the participants were divided into eight teams, to impart the spirit of cooperation and

This programme has been totally funded by a gift from a gen-

Participants of the June ESSO-CMS-PIMS Math Camp.

erous anonymous couple. Students from Washington, British Columbia, Oregon, Alaska, and Idaho are encouraged to apply for SIMUW 2004. For more information please see **www.math.washington.edu/~simuw/.**

to teach them to engage in discussions about mathematics. All the activities, including the final contest, were conducted as team activities. All the participants enjoyed this aspect of the camp very much.

Sessions on puzzles and games, patterns and building geometrical models were included in daily camp activities. In addition, the participants had also an opportunity to explore the SFU Burnaby campus during the afternoon of the first day. They also visited our Centre for the Experimental and Constructive Mathematics and the CoLab, where they explored our space-age computer technology and participated in a presentation on knots, given by Dr. Rob Scharein. For more information please see the camp website at **http://www.cecm.sfu.ca/~lisonek/MathCamp.htm**

Alberta High School Mathematics Competition

The Alberta High School Mathematics Competition is an annual two-part competition that takes place in November and February of each school year. There are book prizes for the first part, and cash prizes and scholarships for the second part. The first part of the 49th annual Alberta High School Mathematics competition was written on November 16, 2004 by 810 students representing 42 schools. The results were:

First Prize: Malka Wrigley, Old Scona Academic High School, Edmonton AB
Second Prize: Ken Zhang, Western Canada High School, Calgary AB
Third Prize: Zheng Guo, Western Canada High School, Calgary, and Yakov Shklarov, Henry Wise Wood High School, Calgary AB For a complete list of top finishers please see the website **www.math.ualberta.ca/~ahsmc.**

31st BC Colleges High School Mathematics Contest

University College of the Cariboo, May 7, 2004

PIMS provided $1000 to UCC for the BC Colleges' High School Math Contest. The contest itself was again a great success this year. Our enrichment talk was given by Dr. Frank Ruskey from University of Victoria. His talk was well received by the students, and his "Venn knot" was a great design for the T-shirts. In addition, during the morning session with Frank, UCC faculty, and the high school teachers, we enjoyed a great discussion on teaching mathematics, and the transition from high school to university. Many teachers were eager to learn about PIMS. We directed them to the website, as well as, shared copies of "Pi in the sky". While the contest was being held at UCC, one of our faculty members Dr. Jim Totten, who has been a driving force behind this contest for many years, travelled to Northwest Community College in Prince Rupert. There he assisted Mona Izumi with hosting the contest for the first time in Prince Rupert. I should point out that Mona is the sole mathematician at NWCC in Prince Rupert, making it difficult for her to launch the contest in Prince Rupert. I am sure that the students in Prince Rupert enjoyed Jim's collection of mathematical puzzles and games. Certainly, his passion for mathematics must have left a big impression on the students.

Participants of the 31st Annual BC Colleges High School Mathematics Contest.

The funds we received from PIMS are greatly appreciated. We used them partly to pay for some of the T-shirt costs, and partly to pay some of Jim's travel costs. The BC Colleges' High School Mathematics Contest has always been about participation and not competition. In this respect it is a wonderful mathematics outreach activity. On behalf of the UCC Department of Mathematics and Statistics, I thank PIMS for helping support and expand the contest.

PIMS Elementary Grades Math Contest

University of British Columbia, May 29, 2004

The sixth Annual PIMS Elementary Grades Mathematics Contest (ELMACON) was organized by Shelley Alvarado, Cary Chien, Olga German, Klaus Hoechsmann, Heather Jenkins, Ilija

The top 10 ELMACON winners in Grade 7.

Katic, Joshua Keshet, Fanny Lui, Natasa Sirotic and Elizabeth Towers.

The contest ran smoothly with about 50 on-site volunteers including Jerry Chien and Sylvia Chan.

A total of 244 students competed: 75 in Grade 5, 99 in Grade 6, and 70 in Grade 7.

Each contestant received a score between 0 and 49, calculated by adding their Sprint Round score (0-25) to double theirTarget Round score (0-24). The top ten scorers went on to the Countdown round, where one-on-one competition caused some changes to the rankings based on written work alone.

The top 10 ELMACON winners in Grade 6.

The top ten in each grade were:

Grade 5: 1. Roger Zhang (42) 2. Brian Chau (39) 3. Hung-Yi Lee (38) 4. Joshua Ryu (27) 5. Kevin Chu (37) 6. Raymond Zeng (36) 7. George Ma (35) 8. Jackie (Houzi) Lee (31) 9. Hadrian Lam (30) 10. Alex Yang (27)

Grade 6: 1. Clara Hwang (43) 2. Ellen Tseng (36) 3. Anson Wong (39) 4. Nam-gi Kim (29) 5. Tian Xia (Gloria) Chu (34) 6. Deshin Finlay (31) 7. Anne Zhu (27) 8. Sandra Long (28) 9. Jamieson Lim (27) 10. Christina Cheung (26)

Grade 7: 1. Danny Shi (48) 2. Jack Zhou (44) 3. Jonathan Leung (A. R. MacNeill) (46) 4. Amanda Tu (43) 5. Jeffrey Choi (43) 6. Denny Choi (42) 7. Juno Jung (36) 8. Jason Chan (30) 9. Michael Xie (30) 10. Ryota Takada (29)

Rankings for candidates not in the top ten will not be released.

Please see **http://www.pims.math.ca/educations/2004/elmacon/**

A Contest for Epsilons

University of Victoria, April 26, 2004

The students in the Math and Stat Course Union at the University of Victoria organized a half-day event entitled *Contest for Epsilons* for students in grades 5 7 in the Greater Victoria area. The event took place on April 26, 2004, and there were approximately 250 students who participated. Students were challenged to complete a one-hour, after which they were invited to attend one of the following seminars: Origami, Chaos, Got Your Goat, Wacky Math, Algorithms and Cryptography.

PIMS Math Fair Programme

Math Fairs are particularly suitable for students in Grades 7–12 who are looking for longer term projects to get a feel for the adventure of a self-directed exploration.

PIMS supports math fairs as part of the Greater Vancouver Regional Fair and the Calgary Youth Science Fair, as well as running its own Forever Annual Mathematics Exhibition in Vancouver and numerous math fairs in Alberta.

The Concept of a Math Fair

Unlike, say, sports or music, mathematics does not offer many extracurricular activities in school, except for various kinds of contests, which—for all their admirable motivating qualities—stress just one side of mathematics: the quick grasp. And yet, most mathematical work could be more aptly likened to a marathon than to a sprint. The steadfast persevering quest, so vital to the subject, is minimally represented in the school environment.

The use of science fairs as a vehicle for popularizing and teaching mathematics might eventually prove to be a way of filling this void. It is still in its infancy—the wheel has not yet been invented. Mathematics is traditionally not a showy subject. When we get a problem to work on, we retreat into a corner like a squirrel with a nut and come back into the light of day only when we have cracked it. Sure enough, we need some time for quiet concentration. But must it be unrelieved solitary confinement? There ought be a better way—and preparing projects for public display might help push us in the right direction.

The projects usually fall under one of the following three headings, although many will present a mixture of two or even all three of them.

Original Research: There are lots and lots of open problems in mathematics. However, most of them lie on the outskirts which can only be reached by air. Since the field is so old, most of the rocks near the centre have been turned over more

than once, so finding something really new there is a very lucky break. Nevertheless it happens now and again—and, hey, you never know!

Applications: There is an inexhaustible supply of problems of all shapes and sizes in science, in technology, and even in the arts. Many of them are close to home. The challenge here is to tease out the interesting ones (say, the geometry of rose petals) and not get bogged down in mere routine (like counting them) or too engrossed in extraneous activities (like smelling them).

Exposition: Again and again it happens that somebody gives an old hat a brand-new twist—and most of the time, a new insight comes with it. There are hundreds of ready made proofs of the Pythagorean Theorem, but some people are still rolling their own. The area of the regular dodecagon inside a unit circle (3 square units) had been known for many centuries before recent beautiful proofs were found.

Whichever flag it sails under, a project should always aim at engaging the visitors' minds, not only their eyes. In this connection, a low-tech, homespun implementation is sometimes more successful than a glitzy computerized one—which might impress without enlightening, unless special care is taken.

Calgary Youth Science Fair

On March 18, 2004, the 44th annual Calgary Youth Science Fair took place in the Big Four Building on the Calgary Stampede Grounds. Over 1,000 students from Grades 5-12 participated in the event, where they discussed and demonstrated all that they know and understand about the world of science.

For more information about the Calgary Youth Science Fair see **www.cysf.org**

Gary Margrave (PIMS Site Director, U. Calgary) & Malcolm Stagg in front of Malcolm's project.

BC Science Fair Foundation

At the Greater Vancouver Regional Fair (GVRSF) PIMS supplies judges, mathematical expertise, and prizes. PIMS initiated the inclusion of a Mathematical Sciences exhibit category within the existing Science Fairs, which are organized and administered by the Science Fair Foundation of British Columbia. PIMS is committed to informing and involving mathematics teachers, giving presentations and workshops to groups of students, helping and providing assistance to students that have undertaken mathematics projects, judging the projects, and supplying the monetary awards.

The Greater Vancouver Regional Science Fair took place at UBC on April 1–3, 2004.

Projects are judged as gold, silver or bronze based on a point system.

The first prize winner received $200, the second prize winners $100 each, and the third prize winners $50 each.

PIMS contributed $2500 travel money to send the two winners to the Canada-Wide Science Fair.

Forever Annual Mathematics Exhibition (FAME)

On May 13, 2004 students in the Greater Victoria School district participated in the annual Forever Annual Mathematics Exhibition (FAME) at S. J. Willis Educational Centre. A total of 100 exhibits were entered in the event. The exhibits presented at FAME are judged for creativity, skill, dramatic value, and mathematical thought. Every entrant was given an award and school trophy is presented at each of the three levels of competition (junior, intermediate, senior).

Elementary Math Fairs in Alberta

The Math Fairs in elementary schools in the Edmonton area are gaining in popularity. Initiated upon requests by schools, and supported mainly by PIMS and the Edmonton Public School Board, the Math Fairs were held in previous years at Our Lady of Victories, Parkallen Elementary, and Terrace Heights Schools. The Edmonton Math Fairs are unique in that all students in the school participate. This event is about problem solving, not winning and losing. The schools themselves play a major role in the planning and thus the format can vary from school to school. In some Math Fairs, Education students from the University of Alberta were available to help, primarily by providing a "model" for a Math Fair that students can emulate in planning their own event. The extensive involvement of students in planning, staging and participating in the Math Fair may be one of the secrets of its success.

Prior to the Math Fair, students choose or are given problems to work on. They work in small groups to solve the problem and subsequently create a tabletop display. On the day of the Math Fair, spectators are invited to tackle the problem, with hints and guidance provided by students in charge. The displays are not poster sessions. Rather, the students are actively involved in the presentations.

Ted Lewis and Andy Liu (Math, University of. Alberta) trained math fair organizers in 2003 and in 2004 at BIRS. Their own direct organization of math fairs is restricted to the practicum portion of Math 160 which consists of a large math fair in Dinwoodie at SUB each term. Many of our graduate students generously volunteer their time in support of these fairs.

That's a Good Problem! Math Fairs in Calgary

That's a Good Problem! Is a collaborative project of the Galileo Educational Network (GENA), Mount Royal College in Calgary and PIMS. It is based on the highly successful math fairs organized by Ted Lewis (PIMS Education Coordinator, University of Alberta). Teams of teachers from several Calgary-area schools were invited to a half-day workshop. The focus of the workshop was on teaching mathematics through explorations and investigations by working through a number of mathematical explorations, suggestions for introducing explorations to other teachers, organizing and promoting a school math fair.

Having fun learning math with a frog game.

The teachers returned to their schools armed with Ted Lewis' excellent booklet on how to run a math fair. Sharon Friesen of GENA and Indy Lagu (PIMS Education Coordinator, Calgary) made visits to the schools to work with the teachers and students before the math fairs.

After the math fairs, the teachers were invited for another half-day workshop to talk about problem solving, what worked and what did not with their fairs, and future steps. Many of the teachers admitted that they were worried about how successful their math fair would be, but none were disappointed, and all thought of the math fair as an unqualified success. The many parents who attended the math fairs were also quite impressed. In all, seven schools participated, and all expressed an interest in repeating a math fair.

Half-day workshops were also held with teachers about the math fairs.

More information about the math fairs (including lots of photographs) can be found at **www.galileo.org/math/sumtalk/**

Initiatives for Undergraduate Students

PIMS Graduate Weekends

This annual PIMS programme is unique in Western Canada, providing a forum in which talented undergraduates can preview and select the speciality which best suits their interests and ability. The payoff is many-faceted: Groups and laboratories are populated with better-matched students, students get the programmes they really want, and the strength of Western Canada's mathematical sciences is promoted.

PIMS Graduate Information Event UVic, UBC, SFU, January 8–13, 2004

This year the PIMS Graduate Information Event was hosted in British Columbia. About 30 senior undergraduate students from all over Canada spent Friday at Simon Fraser University and Saturday at the University of British Columbia. At SFU students were welcomed by Jonathan Driver (Dean of Graduate Studies) and Rolf Mathewes (Associate Dean of Science). Students heard presentations from representatives from various graduate programmes, notably Pure Mathematics, Applied Mathematics, Computer Science and Statistics. The Universities of Alberta and Calgary also had faculty representatives at the SFU event. Students had the opportunity to see the campus and various research labs; there was also ample opportunity to meet informally with faculty members and graduate students.

PIMS at the University of Victoria hosted the second part of the Graduate Information event. After arriving on Sunday, the students were free to explore the city. In the evening, a reception was held at the Executive House Hotel, host hotel for the participants. There, the students were able to meet informally with faculty and graduate students from the Departments of Mathematics and Statistics, Physics and Computer Science.

On Monday, the students came to the University of Victoria campus where Aaron Devor (Dean of Graduate Studies) welcomed them. Then they heard presentations from faculty and graduate students on graduate degree programs in pure, applied and discrete mathematics, statistics, physics and astronomy, and computer science. The participants ended their day at UVic with a brief tour of the campus.

We are grateful for the generous support provided to this event by the participating universities and departments, as well as for the efforts of faculty members, graduate students and local PIMS staff.

3rd PIMS Mathematics of Biological Systems Summer Workshop University of Alberta, May 4–14, 2004

For more information please see page 73.

Initiatives for Graduate Students

Graduate Industrial Math Modelling Camps

Each spring PIMS sponsors a five-day workshop for graduate students on industrial mathematical modelling. The goal of the Graduate Industrial Math Modelling Camp (GIMMC) is to provide experience in the use of mathematical modelling as a problem solving tool for graduate students in mathematics, applied mathematics, statistics, and computer science.

GIMMC is one of two components of the annual PIMS Industrial Forum. The other component is the Industrial Problem Solving Workshop. At this workshop, industrial and academic mathematicians work together to solve particular problems posed by industrial sponsors. Graduate students who are accepted to the Mathematical Modelling Camp are also invited to this Workshop.

Students work together in teams, under the supervision of invited mentors. Each mentor poses a problem arising from an industrial or engineering application and guides his or her team of graduate students through a modelling phase to a resolution. At the end of the workshop, reports are presented and a written summary of conclusions is made available for distribution.

Outstanding graduate students at both the Masters and Ph.D. levels in the fields of mathematics, applied mathematics, statistics, and computer science, or related disciplines, are invited to apply.

7th PIMS-MITACS Graduate Mathematics Modelling Camp

May 10–14, 2004, University of Victoria

For more information please see page 74.

Frontiers of Mathematical Physics: Summer School on Strings, Gravity, and Cosmology

August 3–13, 2004, PIMS UBC

For more information please see page 37.

PIMS-MITACS Summer School in Probability

May 25– June 25, 2004, PIMS UBC

For more information please see page 74.

MSRI-PIMS Summer Graduate Programme: Knots and 3-Manifolds

July 7–20, 2004, University of British Columbia, Vancouver

For more information please see page 36.

PIMS-MITACS Minicourse in Mathematical Finance

June 14–18, 2004, PIMS UBC

For more information please see page 74.

Initiatives with Mathematics Educators

With new mathematics curricula being developed across Western Canada, PIMS scientists have found considerable demand for teacher training and retraining. Teachers are also interested in exchanging ideas with academics.

PIMS Conferences on Changing the Culture

Organized by M. Dubiel (SFU), P. Hagen (Westwood Elementary), K. Heinrich (SFU), B. McAskill (BC Ministry of Education), E. Perkins (UBC), these conferences are intended to forge closer ties between the mathematics community, mathematics teachers and the industry. Erasing barriers between these communities and looking for common ground is an essential step in any attempts at changing the mathematics culture.

2004 Changing the Culture Conference

April 23, 2004, SFU Harbour Centre,

The seventh annual Changing the Culture conference, sponsored and supported by the Pacific Institute for the Mathematical Sciences, was held April 23rd, 2004, at the SFU Harbour Centre campus, 515 W. Hastings Street, Vancouver.

Over the last seven years, the conference has become a forum gathering schoolteachers from all levels, and faculty and graduate students from colleges and universities. Participants discuss issues relating to education in mathematics, and work together towards improving the teaching and image of mathematics. This year, over ninety participants took part in talks, workshops and discussions focusing on school mathematics curriculums, and students' preparation for university courses, including Calculus and Mathematics for Elementary School Teachers.

Ivar Ekeland, Director of the Pacific Institute welcomed the participants for the Mathematical Sciences. Three plenary talks formed the core of the conference. Stewart Craven from the Toronto School Board spoke about the recent changes in the Ontario school curriculum: compression from 13 to 12 grades, a total redesign of the curriculum, and its effects on the first new cohort which graduated last June. His talk was followed by a short talk by Peter Liljedahl, Faculty of Education, SFU, Process or Product: Exactly What Is It We Want From Our Students? Peter explored some of the problems with the BC curriculum, as an introduction to this year's workshops.

The participants had a choice to join one of the three workshops for the duration of the conference. The workshops focused on students' preparation for High School, for Calculus, and for the Mathematics for Elementary School Teachers courses offered at BC universities and colleges, in an attempt to identify what we really would like students to learn in school.

In the afternoon, a panel discussion, with Katharine Borgen, VSB/UBC, Bernice Kastner, Towson University, Petra Menz, SFU and Katie Pirquet, Edward Milne School, looked at various aspects of curriculum, from the historical through textbooks, classroom experiences, the role of the teacher, and shared personal reflections.

The conference ended with a talk A Community of Learners: Preparing Students for University and for Life, by Elaine Simmt, Faculty of Education, University of Alberta. Elaine talked about her experiences working with grade 7 teachers and students over the course of a school year, to illustrate the issues involved in achieving the desired proficiencies while using the teaching methods being promoted in the new curricula.

You can find more information about the conference at the conference website **www.pims.math.ca/ctc.**

Teacher Association Meeting

Annual meetings of teacher associations provide an important venue for connections between PIMS researchers and school teachers. PIMS participated in the big 2003 October meetings of the British Columbia Association of Mathematics Teachers (BCAMT). PIMS had a display table there.

North-South Dialogue

The first North South Dialogue was held in Calgary in 2001 and the second in Edmonton in 2002. The interest and scope of the meeting has increased enormously over this short period of time, from a meeting involving primarily the University of Alberta (North) and the University of Calgary (South), to a meeting involving the mathematics departments of many of Alberta's institutions of higher learning. Those in attendance were: Augustana College, Concordia College, Grand Prairie Regional College, Mount Royal College, Red Deer College, and the Universities of Lethbridge, Alberta and Calgary. The programme for the meeting was also somewhat expanded, with a special session for graduate students added on Sunday. In addition to the Albertans, visitors from B.C., New York, India, and others participated actively in the meeting, adding diverse viewpoints and comparisons.

Fourth North-South Dialogue

Red Deer College, Red Deer, AB, May 8–9, 2004

This year's meeting was held at the Red Deer College on May 8 and 9, 2004. The College Mathematics Meeting at RDC, on May 7 preceded it. Coordination among organizers of both meetings allowed several themes to begin on Friday and continue through the weekend. Many high school teachers also attended the meetings. This year's gathering addressed all levels of mathematics in Alberta from elementary school through postdoctoral research. The objectives of the meeting have expanded to include all issues involving higher education in mathematics in the province, as well as allowing a chance to meet those involved. Since 2002, the North-South Dialogue has received full funding from the Pacific Institute of Mathematical Sciences (PIMS). Dr. Ivar Ekeland was the keynote speaker at this year's banquet.

The organizers would like to thank Michael Li (University of Alberta) most of all for his constant help and support in planning the meeting, and also great thanks are due to PIMS for their overall support, as well as the local PIMS support from Gary Margrave and Marion Miles, to the Chairs of the two large departments (Tony Lau from U of A and Ted Bisztriczky from U of C), to all the speakers and session moderators, to ASRA (represented by Steve Vossos) for their support and interest in the meeting, and to many others.

PIMS Collaborates with First Nations Communities in BC

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

Got Your Goat at the Agassiz Math Mania.

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

Math Mania went to the First Nations Community of Agassiz at Seabird Island Community School on February 18, 2005.

The Error Correction Game at the Agassiz Math Mania.

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

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

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

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

JUMP Comes to PIMS

John Mighton.

Junior Undiscovered Math Prodigies (JUMP) is a volunteer based charitable organization that was founded by John Mighton in 1998. Its purpose is to provide free tutoring in mathematics to elementary students, especially those of disadvantaged background. Over the past five years, John Mighton has observed many surprising improvements in mathematical aptitude in students enrolled in JUMP, particularly in students with severe learning disabilities.

On April 26, 2004 John Mighton gave a public talk at UBC: *The Myth of Ability: Nurturing Mathematical Talent in Every Child*. He spoke about the method of instruction used in JUMP and about why he thinks the method works with students who have traditionally struggled with math. This talk will soon be available on the PIMS website in Realvideo format.

On July 29, 2004 John returned to PIMS-UBC to give a follow-up session that covered the JUMP methodology with specific examples from the new workbooks. He also spoke about how one could go about implementing the programme. John Mighton is a mathematician and a Governor General's Award-winning playwright.

For more information about JUMP please see **http://www.jumptutoring.org/**.

PIMS is planning future collaborations with JUMP.

VI. COMMUNICATION OF THE MATHEMATICAL SCIENCES

The cover of the Fall 2004 issue of the PIMS Magazine.

Pi in the Sky

Pi in the Sky magazine 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.

The Editor in Chief is **Ivar Ekeland** (PIMS Director). The rest of the editorial Board consists of **Len Berggren** (SFU), **John Bowman** (U. Alberta), **John Campbell** (Archbishop MacDonald Academic High School, Edmonton), **Florin Diacu** (U. Victoria), **Sharon Friesen** (Galileo Educational Network, Calgary), **Dragos Hrimiuc** (U. Alberta), **Klaus Hoechsmann** (UBC), **Michael Lamoureux** (U. Calgary), **David Leeming** (U. Victoria), **Mark MacLean** (UBC), **Alexander Melnikov** (U. Alberta), **Volker Runde** (U. Alberta) and **Wendy Swonnell** (Lambrick Park Secondary School, Victoria).

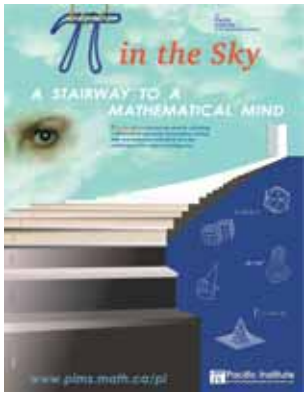
Pi in the Sky accepts materials on any subject related to mathematics or its applications, including articles, problems, cartoons, statements, jokes, etc. Copyright of material submitted to the publisher and accepted for publication remains with the author, with the understanding that the publisher may 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



In Fall 2003 PIMS produced a poster advertising Pi in the Sky Magazine. *This poster was designed by Sarah Bentz who is in her final year of a Bachelor of Design degree in Visual Communication Design at the University of Alberta. The poster was financed by Gary Kachanoski, the Vice President Research at the University of Alberta.*

On May 14, 2004, the Pi in the Sky Editorial Board met at BIRS to define editorial policy and procedures.

The following statement describes the intended audience: *Pi in the Sky Magazine 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.*

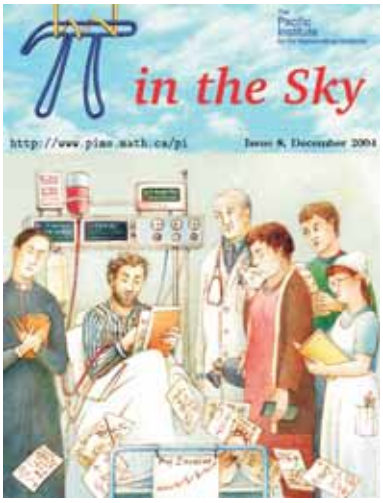
Pi in the Sky can be downloaded for free from **www.pims.math.ca/pi**.

The new editorial board is:

Editor in Chief: Ivar Ekeland (UBC)
Managing Editor: David Leeming (UVic)
Editorial Board: Len Berggren (SFU), John Bowman (UA), John Campbell (Archbishop MacDonald Academic High School, Edmonton), Florin Diacu (UVic), Sharon Friesen (Galileo Educational Network, Calgary), Dragos Hrimiuc (UA), Klaus Hoechsmann (UBC), Wieslaw Krawcewicz (UA), Michael Lamoureux (UC), Mark MacLean (UBC), Alexander Melnikov (UA), Volker Runde (UA), and Wendy Swonnell (Lambrick Park Secondary School, Victoria).
Editorial Coordinator: Heather Jenkins (PIMS).

The December 2004 Issue

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



The front cover of the December 2004 issue of Pi in the Sky.

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

The PIMS Math Fair Booklet

PIMS published the math fair booklet by **Ted Lewis** (PIMS Education Coordinator, U. Alberta) in the Spring of 2002. This is a major new resource for teachers and others interested in math fairs for schools. It is based on the experience of the author and his colleagues over the past few years. It is a rich source of guidelines to organizing math fairs, and to finding suitable problems puzzles and challenges.

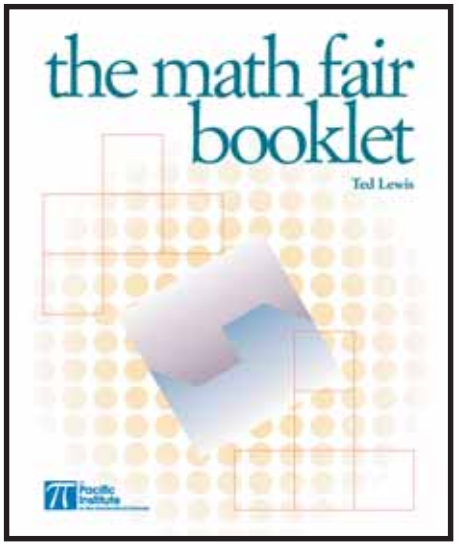
The booklet may be purchased from PIMS University of Alberta for a nominal fee (US$10.00 for shipping and handling in North America, US$15.00 elsewhere).

From the Introduction: The Math Fair Booklet by Ted Lewis

Everybody knows what a science fair is. Students find projects to work on, they prepare posters and demonstrations, the public is invited to come and see what they have done, and a panel of judges awards prizes for projects that are deemed to be the best.

A math fair is similar, but two important differences set our concept apart. Although mathematics is extremely diverse, our math fairs concentrate on just one aspect of the subject, namely problem solving, and our fairs are officially non-competitive, so there are no awards or prizes. We have chosen to focus on problem solving for several reasons. It is one activity that is common to most of mathematics, it is frequently an explicit part of the mathematics curriculum and it encourages skills in students that can be applied in all areas of their lives.

The problems in this booklet are ones that young students can solve and truly understand with a reasonable amount of work. They will not need a broad educational background, but the problems are not simple and most will have to think before



solving them. The same is true about the people who visit the math fair even though they may be adults or students from higher grades. When the participants present their problems, they will discover that the visitors need help to work through the solutions, and the presenters will gain the satisfaction and confidence that comes from helping more talented or older persons.

The interaction between the participants and the viewers at a problem-based math fair can have a profound effect on the poise, confidence, communication skills and patience of the participants. The reason for our second difference, that the math fair be officially non-competitive, is so that all students are encouraged to participate and benefit. If some students feel they have little chance of winning they may decline

to join in or not put in a full effort.

Even if a math fair is officially non-competitive, informal competition does occur. The participants quickly recognize who among them are good problem solvers, who can explain things well, whose presentations have the best artwork, and which displays attract the most visitors. But this sort of competition is friendly and constructive, and frequently leads to co-operative efforts among the participants. The focus on problem solving and the lack of formal awards are the key parts to our concept of a math fair for children, but otherwise there are many opportunities to creatively adapt the concept to a particular situation. We hope you will find this booklet useful in organizing your own math fair and are looking forward to hearing from you about your experiences.

The PIMS Magazine

Scientific Articles that appeared in the PIMS Magazine in 2004-05:

• Volume 8.1: *Long Arithmetic Progressions of Primes* by **Ben Green** (Trinity College, Cambridge)

PIMS Offers Lectures via Streaming Video over the Internet

PIMS now has well over 2000 lectures available over the internet using on-demand streaming video and audio. The lectures are available at **www.pims.math.ca/Publications_and_Videos/Streaming_Videos/**.

There are videos of the lectures in Realvideo format and high resolution JPEG images of the speaker's slides, when possible. MP3 files are also available for listening to for many of the lectures.

The library is divided into six main sections:

• BIRS Workshops
• Ceremonies and Meetings
• Seminar Series and Distinguished Lectures
• Thematic Programmes, Conferences and Workshops
• Minicourses
• Educational Activities

The videos that were added in 2004-05 include the following:

BIRS Workshops

Model Reduction Problems and Matrix Methods
April 3–8, 2004

• **Linda Petzold** (UC Santa Barbara) , *Error Estimation for Reduced Order Models of Dynamical Systems*
• **Jacob White** (Massachusetts Institute of Technology), *Parameterized and Nonlinear Model Order Reduction Techniques and Applications*

Analytic and Geometric Aspects of Stochastic Processes
April 10–15, 2004

• **Terry Lyons** (Oxford University), *Support Theorems*

Knots and their Manifold Stories
May 8–13, 2004

• **Andrew Ranicki** (University of Edinburgh), *Algebraic Transversality and Noncommutative Localization*

New Developments on Variational Methods and their Applications
May 15–20, 2004

• **Yanyan Li** (Rutgers University), *On the Yamabe Problem and a Fully nonlinear Version of it*

Aperiodic Order: Dynamical Systems, Combinatorics, and Operators
May 29–June 3, 2004

• **Valerie Berthe** (Montpellier), *Multidimensional Combinatorics on Words*
• **Robert Moody** (U. Alberta), *Aperiodic Order: Dynamical Systems, Combinatorics and Operators*

Semimartingale Theory and Practice in Finance
June 5–10, 2004

• **Steven Shreve** (Carnegie Mellon University), *A Two-Person Game for Pricing Convertible Bonds*
• **Mihail Zervos** (Kings College London), *Pricing a Class of Exotic Options via Moments and SDP Relaxations*

New Horizons in String Cosmology
June 12–17, 2004

• **Dick Bond** (CITA and University of Toronto), *Experimental View of the Very Early Universe*
• **Andrei Linde** (Stanford University), *Infaltionary Universe*

PIMS-MITACS-MSRI Special Program on Infectious Diseases Summer School
June 19–27, 2004

• **Ping Yan** (Health Canada), *Statistical Issues 3 (super-spreading events)*

Convex Geometric Analysis
July 10–15, 2004

• **Shiri Artstein** (Tel Aviv University), *On Convexified Packing and Entropy Duality*
• **Dario Cordero** (Universite de Marne la Vallee), *Convergence of Information in the Central Limit Theorem*

Modelling Protein Flexibility and Motions
July 17–22, 2004

• **Michael Thorpe** (Arizona State University), *Predicting Flexibility*
• **Walter Whiteley** (York University), *Flexibility and Rigidity for Protein*

Conformal Geometry
July 31– August 5, 2004

• **Kengo Hirchi** (University of Tokyo), *Volume Renormalization of Strictly Pseudoconvex Domains*
• **Paul Tod** (Oxford University), *Conformal Gauge Singularities in General Relativity*

Dynamics, Control and Computation in Biochemical Networks
August 21–26, 2004

• **Drew Endy** (MIT), *Design of Self-Replicating Machines*
• **Tomas Gedeon** (Montana State University), *Structure Theorems and the Mathematics of Gene Regulation in NCR Circuit*

Commutative Algebra: Homological and Birational Theory
September 11–16, 2004

• **Mel Hochster** (University of Michigan), *Tight Closure Operations and Big Cohen-Macaulay Algebras*
• **Vasudevan Srinivas** (Tata Institute of Fundamental Research), *Lefschetz Theorems for the Divisor Class Group*

Braid Groups and Applications
October 16–21, 2004

• **Xiao-Song Lin** (University of California Riverside), *Representations of Braid Group and Coloured HOMFLY Polynomials*

Mathematical Image Analysis and Processing
October 23–28, 2004

• **Ross Whitaker** (University of Utah), *Image Denoising with Unsupervised, Information-Theoretic, Adaptive Filtering*

The Structure of Amenable Systems
October 30– November 4, 2004

• **Marius Dadarlat** (Purdue University), *On the Topology of the Kasparov Groups and its Applications*

Seminar Series and Distinguished Lectures

PIMS-SFU School of Computer Science Distinguished Lecture Series 2004
Simon Fraser University

• **Mahdu Sudan** (MIT), *List Decoding of Error-Correcting Codes,* September 17, 2004
• **Geoffrey Hinton** (University of Toronto), *Learning to Perceive How Handwritten Characters were Drawn,* December 10, 2004

IAM-PIMS-MITACS Joint Distinguished Colloquia, 2004–05
University of British Columbia


Ray Pierrehumbert

• **Ray Pierrehumbert** (University of Chicago), *Early-Life Crises of Habitable Planets*, March 28, 2005
• **Adrian Nachman** (Department of Electrical and Computer Engineering, University of Toronto), *Inverse Problems in Medical Imaging,* March 7, 2005
• **Roger Brockett** (Division of Engineering and Applied Sciences, Harvard University), *Dynamical Systems That Do Tricks*, January 24, 2005
• **Andrea Bertozzi** (University of California at Los Angeles), *Higher Order PDEs in Image Processing*, November 29, 2004
• **Ray Goldstein** (University of Arizona), *A Stirring Tale of Bacterial Swimming and Chemotaxis*, October 25, 2004
• **George Homsy** (University of California, Santa Barbara), *Novel Marangoni Flows*, September 20, 2004


Roger Brockett

Minicourses

Minicourses by PIMS Distinguished Chairs

Dan Rudolph (University of Maryland), PIMS Distinguished Chair, University of Victoria, October 2004

• *Entropy and Orbit Equivalence in Measure Preserving Dynamics* (lecture 1)
• *Entropy and Orbit Equivalence in Measure Preserving Dynamics* (lecture 2)
• *Entropy and Orbit Equivalence in Measure Preserving Dynamics* (lecture 3)

Appendix: Financial Report

The information in this appendix outlines the income and expenses of PIMS for the fiscal year April 1, 2004 to March 31, 2005. PIMS activities are supported by ongoing base funding from the following partners:

• The member institutions (Simon Fraser University, University of Alberta, University of British Columbia, University of Calgary, University of Victoria and University of Washington) and affiliated institutions (University of Lethbridge).

• The government of Canada through the Natural Sciences and Engineering Research Council.

• The government of Alberta through the Alberta Ministry of Innovation and Science (Alberta Science and Research Authority).

• The government of British Columbia through the Ministry of Competition, Science and Enterprise (Science and Information Technology Agency).

PIMS also received substantial contributions from 65 industrial partners (to March 31, 2005) for its industrial programmes and for the PIMS-affiliated MITACS industrial collaborative research projects.

Income for 2004–05

The total income received by PIMS in the 2004–05 fiscal year is listed in Table 1. Each founding university makes an annual cash contribution equivalent to one full-time faculty position at their university at the time of the founding of PIMS. The universities also make considerable inkind contributions of office space, computer labs, and infrastructure, in addition to releasing personnel from teaching duties in order to provide scientific leadership to the institute.

SFU: Simon Fraser University made a cash contribution of $75,000 to the PIMS operating budget. In-kind support in the form of a 4000-square foot research facility is estimated to be $150,000 per annum.

UA: The University of Alberta made a cash contribution of $70,000 to the PIMS operating budget.

UBC: The University of British Columbia made a cash contribution of $277,500 to the PIMS operating budget. In-kind support in the form of a 9000-square foot research facility is estimated to be $280,000 per annum. In addition, the university provides services to PIMS (financial accounts, e.g.) at an estimated value of $30,000 per annum.

UC: The University of Calgary made a cash contribution of $61,000 to the PIMS operating budget.

UVic: The University of Victoria made a cash contribution of $60,000 to the PIMS operating budget. In-kind support in the form of office space is estimated to be $60,000 per annum.

UW: The University of Washington provided in-kind support for administration and scientific leadership estimated at $10,000 USD ($15,000 CAD). Direct expenses incurred at the site office are estimated to be $7,000 USD ($10,000 CAD).

ULeth: The University of Lethbridge, an affiliated institution of PIMS, made a cash contribution of $5,000.

MITACS: The MITACS NCE makes an annual contribution to PIMS to cover the direct expenses of PIMS in providing administration and infrastructure support to the PIMS-affiliated MITACS projects, and for networking activities, theme meetings and workshops.

PIMS Total Income: April 1, 2004 - March 31, 2005

Source	Carry-forward	Income 04/05	Operating Funds	In-Kind Support
NSERC	$356,170	$1,023,100	$1,379,270	
BC (CSE/ISTA)	($49,438)	$127,805	$78,367	
BC (NCE)	$83,709	$33,606	$117,315	
Alberta (ASRA)	$86,176	$200,000	$286,176	
Universities	$93,644	$0	$93,644	
SFU		$75,000	$75,000	$150,000
UAlberta		$70,000	$70,000	$60,000
UBC		$277,500	$277,500	$180,000
UCalgary		$61,000	$61,000	$60,000
UVictoria		$60,000	$60,000	$60,000
ULethbridge		$5,000	$5,000	
UWashington		$0	$0	$25,000
MITACS	$13,045	$155,000	$168,045	
Other**	($65,470)	$118,028	$52,558	
Total	**$517,836**	**$2,206,039**	**$2,723,875**	**$535,000**

*** Does not include industrial contributions to PIMS activities or PIMS/MITACS projects.*

Total Operating Funds	**$2,723,875**
Reserve Fund	**$130,163**
Industrial Funds Received (PIMS/MITACS)	**$252,585**
Total Funds At-Hand	**$3,106,623**
Total In-Kind Support	**$535,000**

Table 1

Industrial Funding

PIMS receives substantial industrial funding in support of its programmes, in particular, various industrial workshops, seminar series and industrial collaboration postdoctoral and graduate student fellowships. PIMS also manages the industrial funds provided by various companies in support of the thirteen MITACS collaborative projects associated with PIMS. A summary of the industrial funding received to March 31, 2005 is given in Table 2.

PIMS and PIMS-MITACS Industrial Funds

Project	Company	Before March/04	April/04-March/05	Total to March/05
Project 1	IBM	$30,000	$0	$30,000
	MDSI	$25,000	$0	$25,000
	StemSoft	$34,500	$0	$34,500
Project 2	Quatronix	$15,000	$0	$15,000
	Sound Logic	$25,000	$0	$25,000
	Webdispatchers.com	$25,000	$0	$25,000
Project 3	Waterloo Maple	$208,750	$0	$208,750
	Workfire Development Corp.	$20,000	$0	$20,000
Project 4	FinancialCAD	$105,000	$8,000	$113,000
	Powerex	$62,000	$0	$62,000
	TransAlta	$42,000	$0	$42,000
	Royal Bank	$5,000	$0	$5,000
	Nexen	$3,333	$0	$3,333
	Storied Places	$0	$7,835	$7,835
Project 5	CREWES	$10,000	$0	$10,000
	Imperial Oil	$30,000	$0	$30,000
	C&C Systems Limited	$10,000	$0	$10,000
Project 6	NORTEL	$120,000	$0	$120,000
Project 7	Kinetek	$15,000	$0	$15,000
	SmithKline Beecham	$160,000	$0	$160,000
	In Silico	$77,556	$0	$77,556
	StemCell	$5,000	$20,000	$25,000
	Bayer	$10,000	$0	$10,000
	Takeda	$2,630	$0	$2,630
	MDS Inc.	$0	$750	$750
Project 8	VisionSmart	$7,473	$0	$7,473
	Lockheed Martin	$98,789	$0	$98,789
	Acoustic Positioning Research	$24,000	$0	$24,000
Project 9	Canadian Airlines	$87,000	$0	$87,000
	BCTel	$43,500	$0	$43,500
	Telus	$43,500	$0	$43,500
	Workers' Compensation Board	$207,500	$0	$207,500
	Vancouver International Airport	$77,750	$0	$77,750
Project 10	Powertech	$20,000	$0	$20,000
	Ballard Power System Inc.	$659,500	$210,000	$869,500
Project 11	Organon Canada	$20,000	$0	$20,000
	Starlab	$8,141	$0	$8,141
	Kinetana	$35,400	$0	$35,400
	National Institute of Health	$5,941	$0	$5,941
	Cybercell	$20,000	$0	$20,000
Project 12	Insightful	$23,814	$0	$23,814
	iCapture (McDonald Research Lab)	$34,000	$0	$34,000
Project 13	Monsanto Company	$2,920	$0	$2,920
	Merak	$2,000	$0	$2,000
	Charles Howard & Associates	$1,000	$0	$1,000
Project 14	Imperial Oil	$4,000	$0	$4,000
	McMillan-McGee	$2,000	$0	$2,000
	Michelin	$2,889	$0	$2,889
	Stern Stewart & Co.	$2,889	$0	$2,889
Project 15	Firebird Semiconductors	$2,000	$0	$2,000
	Algorithmics	$2,000	$0	$2,000
	IBM	$1,974	$0	$1,974
	Microsoft	$3,011	$0	$3,011
	Dept. of National Defence (CSE)	$2,000	$0	$2,000
	AEC Oil & Gas	$2,000	$0	$2,000
Project 16	Firebird Semiconductors	$48,000	$0	$48,000
Project 17	Toronto Dominion	$20,000	$0	$20,000
Project 18	MathSoft	$21,708	$0	$21,708
Project 19	Vortek	$10,000	$0	$10,000
Project 20	Schlumberger (Etudes & Productions)	$96,000	$0	$96,000
Project 21	Schlumberger (Cambridge)	$40,000	$0	$40,000
Project 22	NORTEL/StatCar	$12,604	$0	$12,604
Project 23	Galdos Systems	$15,000	$0	$15,000
Project 24	Capital Health	$2,000	$0	$2,000
	McMillan-McGee	$2,000	$0	$2,000
	RBC Risk Management	$2,000	$0	$2,000
	Semiconductor Insights	$2,000	$0	$2,000
	Shell Canada	$2,000	$0	$2,000
	Talisman Energy	$2,000	$0	$2,000
Project 25	Microsoft Research	$7,531	$0	$7,531
Project 26	Sun MicroSystems	$105,458	$0	$105,458
Project 27	McMillan-McGee	$2,000	$0	$2,000
	Orisar (Semiconductor Insights)	$2,000	$0	$2,000
	Schlumberger	$2,054	$0	$2,054
Project 28	Husky Oil Operations Ltd.	$0	$2,000	$2,000
	Husky Injection Molding Systems Ltd.	$0	$2,000	$2,000
	Michelin Tire Corporation	$0	$2,000	$2,000
	Total	**$2,882,116**	**$252,585**	**$3,134,701**

Table 2

Other Contributions

Table 3 outlines the cash operating budget of PIMS for funds flowing through PIMS accounts at the various sites. Additional contributions in support of PIMS researchers and events are estimated below.

University Infrastructure: PIMS has offices at all five Canadian member institutions. Computational facilities, infrastructure and administrative support are provided. The PIMS central office at UBC is housed in a 4,800 sq ft facility that accommodates up to 40 researchers, plus a seminar room and reading room. The PIMS-SFU site office is housed in a 4,000 sq ft facility that accommodates up to 20 researchers, plus a seminar room.

BC-NCE Infrastructure Support: Only the BC-NCE infrastructure award held at the PIMS central office at UBC is listed in Tables 1 and 3. These funds are made available through the Vice President Research at UBC to support federal NCE activities.

MITACS Projects: The majority of the industrial funds listed in Table 2 go to support the PIMS-affiliated MITACS projects. The NCE matching funds provided by MITACS for these projects are not listed, however, these funds are managed by PIMS.

Additional Support for Industrial PDFs: The PIMS contributions to industrial postdoctoral fellowships ($10- $20K each) are matched (one-to-one) by the corresponding industrial partners. These funds are usually paid as salary directly to the postdoctoral fellow and are not reported here.

Additional Support for Scientific PDFs: The PIMS contributions to scientific postdoctoral fellowships ($20K each) have been at least matched (minimum $20K contribution) by individual research grants and by teaching stipends from the PDF's department. These funds are usually paid as salary directly to the postdoctoral fellow and are not reported here.

Conference Support: Most PIMS conferences receive additional financial support in the form of registration fees, contributions from the research grants of organizing committee members, and/or cosponsorship with other organizations.

Corporate Support: Industrial partners or corporations sometimes contribute to official receptions and banquets connected to scientific and industrial activities. Shell Canada provides lunch and meeting space for the Lunchbox Lectures in Calgary, for example.

Industrial Support: Many industrial outreach events, in particular, the *Graduate Industrial Math Modelling Camp and Industrial Problem Solving Workshop* (among many others) are partially supported by direct and indirect contributions from the industrial participants.

Education Support: Most education activities of PIMS are cosponsored by schools, university departments, provincial ministries of education, and professional societies.

PIMS Summary of Expenditures: April 1, 2004 - March 31, 2005

Expense Category	Budgeted	Actuals	Over/Under
Site Offices	$204,627	$219,256	-$14,629
Scientific Personnel	$92,000	$88,569	$3,431
Central Office	$389,000	$365,404	$23,596
Special Events	$36,000	$51,797	$15,797
Industrial Outreach*	$276,500	$168,470	$108,030
Education Programmes	$99,105	$81,832	$17,273
Scientific Activities	$777,265	$599,140	$178,125
PIMS Postdoctoral Fellows**	$340,000	$281,027	$58,973
Total Expenses	**$2,214,497**	**$1,855,495**	**$359,002**

** Figures include neither industrial funds nor MITACS projects*

*** Figures include neither industrial PDFs nor matching funds*

Source	Operating Funds	Budgeted	Actuals	Carry-forward
NSERC	$1,379,270	$864,800	$720,547	658,723
BC (CSE/ISTA)	$78,367	$202,500	$155,689	-77,321
BC (NCE)	$117,315	$155,000	$29,900	87,414
Alberta (ASRA)	$286,176	$214,500	$155,932	130,244
Universities	$642,144	$609,415	$554,916	87,228
MITACS	$168,045	$30,000	$123,935	44,110
Other	$52,558	$138,282	$114,575	-62,017
Total Expenses	**$2,723,875**	**$2,214,497**	**$1,855,495**	**$868,381**

Table 3

Central Academic Building, PIMS-UA Site Office.

Mathematical Sciences Building, PIMS-UC Site Office.

East Academic Annex, PIMS-SFU Site Office.

Clearihue Building, PIMS-UVic Site Office.

University of Washington Campus, PIMS-UW Site Office.

Corbett Hall, BIRS, Banff Centre.

PIMS Central & UBC Site Office.

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