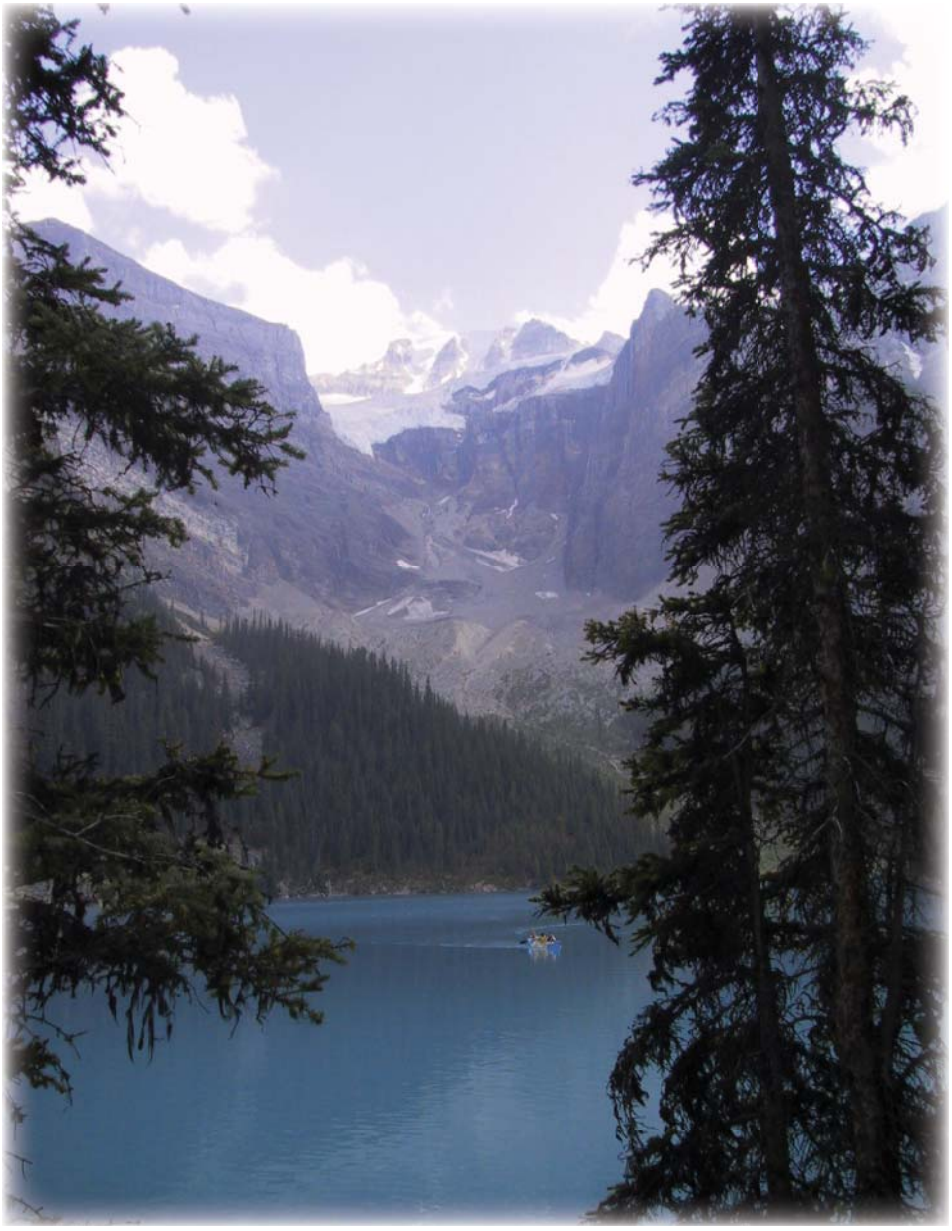
Banff International Research Station
for Mathematical Innovation and Discovery

BIRS 2004/2005 Scientific Report



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Foreword

Inaugurated in 2003, the Banff International Research Station (BIRS) has developed, through a unique scientific partnership between the US and Canada, into a tremendous resource for the world's international scientific community. In three short years 2003/05, the station has hosted over 6000 researchers from 1100 institutions in 60 countries who participated in over 160 different programs spanning almost every aspect of pure, applied, computational and industrial mathematics, statistics, computer science, but also physics, biology, and engineering. The extraordinary response to the opportunities at BIRS has led to extremely high quality competitions with over 450 proposed activities competing for the 170 available weeks in the period 2003-06. The proposals cover huge areas of the basic and engineering sciences as well as economics, finance, psychology and scientific writing. Over 600 scientists from all over the world wrote compelling testimonials on the impact of BIRS on their research (See Book of testimonials on http://www.birs.ca/images/birs/publications/BIRS_testimonials_8-Mar-2005.pdf).

BIRS in 2004 and 2005 was the home of a dazzling array of scientific activities. Besides the tremendously successful 5-day workshops and "Research-in-Teams" programs, BIRS hosted NSF's Focussed Research Groups, Canada's Collaborative Research Teams, Department Chairs meetings and other leadership retreats, gatherings for Women in Mathematics, summer schools in emerging areas, students modeling camps, training sessions for Math Olympiads teams, industrial fora, "ateliers" in scientific writing, as well Bridges conferences for Maths, Music and Arts. BIRS proved to be a unique interdisciplinary forum spanning the whole spectrum of sciences: from multimedia to developmental psychology. BIRS assumed scientific leadership in moments of crisis (e.g., epidemiological issues of SARS and technological challenges of security) and reacted pro-actively to scientific opportunities and challenges (quantum computing, genomics and fuel cells).

BIRS also provided a fertile ground for a collaborative spirit between numerous international institutions dedicated to promote and support the mathematical sciences. Together PIMS, MSRI, IMA, CRM, Fields, MITACS and other organizations coordinate scientific programs and jointly develop schools for the next generation of scientists (PIMS-IMA Graduate Modeling Camps, PIMS-MITACS-MSRI school in infectious diseases, etc...). At BIRS, they gathered with the professional societies (CMS, AMS, CAIMS, AARMS, ISM) in leadership retreats to jointly plan and develop long term scientific visions for the North American community.

Here are some of the other highlights at the station in 2004/05:

The first summer school in analytical development economics organized by the fellows of BREAD (Bureau for Research and Economic Analysis of Development), was hosted at BIRS from June 25 to July 1, 2005.

On the K-12 front, Canadian high school students did extremely well winning one Gold Medal, two silver, and two Bronze Medals at the 46th International Mathematical Olympiad in (IMO) Mérida, Mexico, after training for two weeks at BIRS from June 25 to July 10, 2005. On the other hand, the second Alberta Post-secondary Curriculum Conference was held at BIRS to discuss further and to report on onging plans for a major revision and development of a core curriculum for Alberta Colleges and Universities, focusing primarily on Analysis in the first two years.

The *Pacific Rim International Mathematical Association* (PRIMA) was launched during a mathematical forum at BIRS (October 13 to 16, 2005) that included more than 35 scientists representing

the leading mathematical institutions around the pacific rim. The main objective of the forum was to exchange points of view and information in order to develop a blueprint for comprehensive interactions between Pacific Rim mathematicians.

The *Canada-Chile meeting* on the mathematics of economic geography and natural resource management brought together mathematicians and economists from all over the Pacific Rim. They dealt with the mathematical problems related to the management of natural non-renewable resources - be it oil and mineral deposits, land, forestry and biodiversity, clean air and water - which is quickly becoming the major international problem of the day.

Connecting Women in Mathematics Across Canada II (July 2005) continued the work started by the very successful CWiMAC conference for women graduate students in the mathematical sciences, which took place in 2003, at the University of Alberta.

The overwhelming response of the scientific community during the first three years of operations lead us to set the following goals for BIRS:

1. Expand the North American partnership by involving the Mexican mathematical community in the scientific management of BIRS and in its operations.

2. Increase the BIRS opportunities by extending the program from 40 to 44 weeks in 2006, and to 48 weeks per year starting in 2007. The decision to expand the BIRS opportunities is a result of a thorough joint multi-national review of the station held in March 2005 by NSERC, NSF, ASRA in collaboration with the new BIRS sponsor, Mexicos National Council for Science and Technology (CONACYT).

3. Strengthen BIRS commitment to Women in Mathematics and other underrepresented groups.

4. Intensify the involvement of BIRS in K-12 education, including teachers training.

5. Develop additional summer schools in emerging areas of the mathematical sciences and their applications.

6. Improve the dissemination of all research, and educational material developed at BIRS.

7. Develop a robust evaluation and assessment system for the impact of BIRS.

BIRS is committed to achieve all of these goals within the next two years. Stay tuned!

Nassif Ghoussoub
Scientific Director
Banff International Research Station

Contents

2004

2005

Banff International Research Station

2004

5-day Workshops

Interactions Between Model Theory and Geometry March 13–18, 2004

Organizers:

Deirdre Haskell (McMaster University)
Jan Denef (Leuven)
Ehud Hrushovski (Hebrew University)
Angus Macintyre (Edinburgh)
Anand Pillay (UIUC)
Patrick Speissegger (Wisconsin & McMaster)

Model theory is in a period of rich activity. Advances in pure model theory are finding immediate applications, in particular to the model theory of fields, while the applications are themselves motivating the abstract developments. Applied model theory is using ideas and methods from other parts of mathematics, ranging from homology theory to complex analytic geometry. These two strands of research were exhibited at the BIRS workshop which was used as an opportunity to exhibit and elucidate two large pieces of technical work which have been in the process of development for several years. The first of these, "Homology in o-minimal theories" is a prime example of the way in which a mathematical tool can be developed to apply in a wider model-theoretic context. The second tutorial, "Imaginaries in valued fields" illustrates the way in which an applied context (in this case, an algebraically closed valued field) has motivated a theoretical development (the notion of stable domination). The three afternoon sessions presented recent research developments in three different active areas of research in applied model theory.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5534/

Participants:

Aschenbrenner, Matthias (University of Illinois, Chicago)
Belair, Luc (Université du Québec à Montréal)
Ben Yaacov, Itay (MIT)
Berarducci, Alessandro (Universita' di Pisa)
Bouscaren, Elisabeth (Universite Denis-Diderot Paris 7)
Buium, Alexandru (1 University of New Mexico)
Chatzidakis, Zoé (CNRS - Université Paris 7)
Cherlin, Gregory (Rutgers, The State University of New Jersey)
Cluckers, Raf (École normale supérieure)
Dolich, Alf (University of Wisconsin)
Ealy, Clifton (UC-Berkeley)
Edmundo, Mario (CMAF-University of Lisbon)
Hart, Bradd (McMaster University)
Haskell, Deirdre (McMaster University)
Hrushovski, Ehud (Hebrew University)
Kowalski, Piotr (UIUC)
Lippel, David (McMaster University)
Lipshitz, Leonard (Purdue University)
Loeser, François (École Normale Supérieure)
Macintyre, Angus (The University of Edinburgh)
Macpherson, Dugald (University of Leeds)
Miller, Chris (Ohio State)
Moosa, Rahim (MIT)
Mustafin, Yerulan (Universite du Quebec a Montreal)
Peterzil, Yaacov (University of Haifa)
Pillay, Anand (UIUC)
Robinson, Zachary (East Carolina University)
Rolin, Jean-Phillipe (Université de Bourgogne, France)
Scanlon, Thomas (UC-Berkeley)
Scowcroft, Philip (Wesleyan University)
Singer, Michael (North Carolina State University)
Speissegger, Patrick (Wisconsin & McMaster)
Starchenko, Sergei (Notre Dame)
Steinhorn, Charles (Vassar College)
Tent, Katrin (Mathematisches Institut der Universität Würzburg)
Tomasic, Ivan (Universite Lyon I)
Wagner, Frank (Universite Claude Bernard Lyon I)
Wood, Carol (Wesleyan University)
Yaffe, Yoav (McMaster University)

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

Organizers:

Ian Hambleton (McMaster University)
Erik Pedersen (SUNY Binghamton)
Gunnar Carlsson (Stanford University)

The purpose of this meeting was to bring together researchers in a wide variety of areas in algebraic and geometric topology, to investigate problems of current interest, and to make new connections. In particular, we believe the time was ripe for a productive exchange of ideas and viewpoints among mathematicians in active areas of homotopy theory and the topology of manifolds, in the hope of enriching the future development of both subjects.
Here are some of their research interests:
(1) "Structured homotopy theory", meaning homotopy theory on the category of modules over a ring spectrum
(2) Controlled and equivariant surgery
(3) Conjectures of Baum-Connes and Novikov on assembly maps in K-theory and L-theory
(4) New product structures on the homology of the free loop space of a manifold, moduli spaces
(5) Smoothing of homotopy actions of finite groups on spheres, and free simplicial actions of finite groups on products of spheres
(6) p-compact groups and the smoothing of finite H-spaces

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5533/

Participants:

Adem, Alejandro (University of Wisconsin-Madison)
Anderson, Laura (Binghamton)
Banagl, Markus (Cincinnati)
Bauer, Tilman (Westfälische Wilhelms-Universität Münster)
Carlsson, Gunnar (Stanford University)
Cohen, Ralph (Stanford University)
Connolly, Francis X. (University of Notre Dame)
Crowley, Dairmuid (Penn State)
Davis, James F. (Indiana University)
Dundas, Bjoern (Norwegian University of Science and Technology)
Friedman, Greg (Yale University)
Ganter, Nora (MIT)
Godin, Veronique (Stanford University)
Goldfarb, Boris (University of Albany)
Grinberg, Anna (UC-San Diego)
Grodal, Jesper (University of Chicago)
Hambleton, Ian (McMaster University)
Hughes, Bruce (Vanderbilt)
Kitchloo, Nitu (Johns Hopkins)
Klein, John (Wayne State University)
Korzeniewski, Andrew (University of Edinburgh)
Kreck, Matthias (Heidelberg)
Lawson, Tyler (Stanford University)
Lueck, Wolfgang (Muenster)
Mandell, Michael A. (University of Chicago)
Nicas, Andrew (McMaster)
Noohi, Behrang (University of Western Ontario)
Paulo Santos, Joao (MIT)
Pedersen, Erik (SUNY Binghamton)
Quinn, Frank (Virginia Tech)
Ranicki, Andrew (University of Edinburgh)
Reich, Holger (Muenster)
Roendigs, Oliver (University of Western Ontario)
Rosenthal, David (McMaster)
Scull, Laura (University of British Columbia)
Wahl, Nathalie (Aarhus)
Williams, Bruce (Notre Dame)

Orthogonal Polynomials; Interdisciplinary Aspects
March 27–April 1, 2004

Organizers:

Jacek Szmigielski (University of Saskatchewan)
Percy Deift (Courant Institute)
Lance Littlejohn (Utah State University)
David Sattinger (Yale University)

There have been several regularly scheduled meetings in North America, Europe, and Asia in the subjects of orthogonal polynomials, special functions and their applications over the past twenty years. Indeed, meetings have been held in Bar-Le-Duc, France (1984), Segovia, Spain (1986), Columbus, Ohio (1989), Erice, Sicily (1990), Granada, Spain (1991), Evian, France (1992), Delft, The Netherlands (1994), Sevilla, Spain (1997), Patras, Greece (1999), Hong Kong (1999), and Rome (2001).

At the summer meeting of the CMS held in Saskatoon in 2001 one of the sessions was devoted to integrable systems, inverse scattering theory and emerging links with the theory of orthogonal polynomials. There was a general consensus among the participants that there was a great need for a continuing dialog between different groups of users of the theory of orthogonal polynomials and the orthogonal polynomials theorists. Several of the proposed participants would come from the integrable systems community present in that special session of the CMS.

In general terms, the workshop objectives were to highlight and explore the emerging new areas of applications as well as to identify challenging problems common to the following areas of mathematics, mathematical physics and theoretical physics:

1. Functional/classical analysis theory of orthogonal polynomials 2. Integrable systems and soliton theory 3. Random matrix theory 3. Integrable models of statistical mechanics 4. Theory of coherent states in Quantum Mechanics

The workshop was not talks intensive; the main objective was to focus on challenges as they present themselves in the identified areas.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5530/

Participants:

Adler, M. (Brandeis University)
Arvesu, Jorge (Universidad Carlos III de Madrid)
Askey, Richard (University of Wisconsin-Madison)
Atakishiyev, Natig (UNAM)
Berg, Christian (University of Copenhagen)
Bertola , Marco (Concordia University)
Borodin , Alexei (California Institute of Technology)
Deift, Percy (Courant Institute)
Geronimo, Jeff (Georgia Institute of Technology)
Grunbaum, Alberto (UC-Berkeley)
Harnad , John (Concordia University)
Ismail, Mourad (University of Central Florida)
Kuijlaars, Arno (Katholiek Universiteit Leuven)
Lee, Dong Won (Kyungpook National University)
Littlejohn, Lance (Utah State University)
Lundmark, Hans (Linköping University)
Marcellan, Francisco (Universidad carlos III de Madrid)
McLaughlin , Ken (University of North Carolina)
Mehta, Madan (Service de Physique Theorique)
Miller, Peter (University of Michigan)
Mohajer, Keivan (University of Saskatchewan)
Odzijewicz, Anatol (University of Bialystok)
Ruffing, Andreas (Munich University of Technology)
Sattinger, David (Yale University)
Suslov, Sergei (Arizona State University)
Szmigielski, Jacek (University of Saskatchewan)
Takata, Tomohiro (Kyoto University)
Tuncer, Davut (Utah State University)
Van Assche, Walter (Katholieke Universiteit Leuven)
Vanlessen, Maarten (Katholieke Universiteit Leuven)
Vinet, Luc (McGill University)
Xu, Yuan (University of Oregon)

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

Organizers:

Anne Greenbaum (University of Washington)
Gene Golub (Stanford University)
Jim Varah (University of British Columbia)

This workshop focussed on techniques from numerical linear algebra and ordinary differential equations for model reduction problems in dynamical systems and control. A goal was to bring together people from industry and other areas of academia working on problems involving model reduction and numerical analysts studying applicable solution techniques. Of particular interests were very large nonsymmetric systems of linear equations and eigenvalue problems. Preconditioners play an important part in such algorithms, and here questions of inner/outer iterations must be addressed. Effects of finite precision arithmetic are similar to those of inexact solution of a preconditioning matrix, and recent work in this area was also included.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5513/

Participants:

Antoulas, Thanos (Rice University)
Ascher, Uri (University of British Columbia)
Bai, Zhaojun (UC-Davis)
Benner, Peter (Technische Universität Chemnitz)
Boley, Daniel (University of Minnesota)
Chan, Raymond (Chinese University of Hong Kong)
Cuyt, Annie (University of Antwerp)
Daniel, Luca (MIT)
Elfadel, Abe (IBM T.J. Watson Research Center)
Freund, Roland (Bell Laboratories)
Gallivan, Kyle (Florida State University)
Gemignani, Luca (University of Pisa)
Golub, Gene (Stanford University)
Greenbaum, Anne (University of Washington)
Greif, Chen (University of British Columbia)
Gu, Ming (UC-Berkeley)
Gugercin, Serkan (Virginia Polytechnic Institute)
Hui, Huang (University of British Columbia)
Kwok, Felix (Stanford University)
MacKinnon-Cormier, Sarah (University of British Columbia)
Machorro, Eric (University of Washington)
Meerbergen, Karl (Free Field Technologies)
Megretski, Alexandre (MIT)
Olsson, Henrik (Royal Institute of Technology)
Petzold, Linda (UC-Santa Barbara)
Reichel, Lothar (Kent State University)
Roychowdhury, Jaijeet (University of Minnesota)
Sameh, Ahmed (Purdue University)
Sorensen, Dan (Rice University)
Stykel, Tatjana (Technische Universität Berlin)
Van Dooren, Paul (Universite Catholique de Louvain)
Varah, Jim (University of British Columbia)
Verdonk, Brigitte (University of Antwerp)
White, Jacob (MIT)
Willcox, Karen (MIT)
Ye, Qiang (University of Kentucky)

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

Organizers:

Martin Barlow (University of British Columbia)
Alexander Grigoryan (Imperial College, London)
Elton Hsu (Northwestern University)

The conference was attended by about 35 participants, including Ph.D. students, postdoctoral fellows, young researchers and international leaders in stochastic analyis and related fields. What follows was an attempt to focus on some of the key topics discussed at the meeting both in the lectures and in the informal meeting rooms.

1. Brownian motion and classical analysis

The original development of this area arises from the link between Brownian motion, the heat equation, and classical potential theory. One should see this link as acting in both directions — that is, both sets of objects are of mathematical interest, and one can exploit these connections to (e.g.) use Brownian motion to study harmonic functions on domains in $\boldsymbol{R}^d$, or properties of the heat equation to refine estimates on Brownian motion. With the late P.A. Meyer, we rather regret the view (common in the USA at points in the last century) that regards work on stochastic processes as only interesting if it leads to some result in analysis.

2. Diffusions, stochastic differential equations and calculus on manifolds

The connection between Markov processes, potential theory and differential equations is much broader than just that between Brownian motion and classical analysis. In this section we describe connections between diffusions and various geometric objects.

3. Jump processes

4. Infinite dimensional analysis

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5023/

Participants:

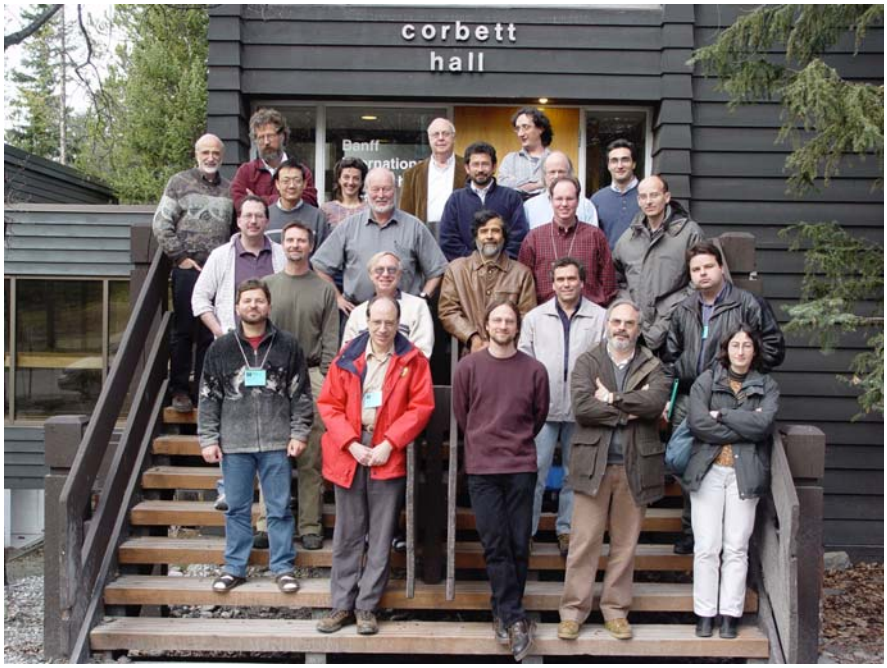
Aida, Shigeki (Osaka University)
Banuelos, Rodrigo (Purdue University)
Barlow, Martin (University of British Columbia)
Bauer, Robert (University of Illinois, Urbana-Champaign)
Burdzy, Chris (University of Washington)
Chen, Zhen-Qing (University of Washington)
Coulhon, Thierry (Universite de Cergy-Pontoise)
Deuschel, J-D. (Technische Universitat Berlin)
Driver, Bruce (UC-San Diego)
Elworthy, Kenneth D. (University of Warwick)
Gordina, Maria (University of Connecticut)
Hambly, Ben (University of Oxford)
Hsu, Elton (Northwestern University)
Kassmann, Rolf Moritz (University of Connecticut)
Kumagai, Takashi (Cornell University)
LeJan, Yves (Universite Paris Sud)
Levin, David (University of Utah)
Li, Xue-Mei (The Nottingham Trent University)
Limic, Vlada (University of British Columbia)
Lyons, Terry (University of Oxford)
McDonald, Patrick (New College of Florida)
Melcher, Tai (UC-San Diego)
Mendez, Pedro J. (University of Utah)
Metz, Volker (Universitat Bielefeld)
Neel, Robert (Harvard University)
Popescu, Ionel (MIT)
Rivasplata, Omar (University of Alberta)
Saloff-Coste, Laurent (Cornell University)
Song, Renming (University of Illinois, Urbana-Champaign)
Sturm, Anja (University of British Columbia)
Sturm, Karl-T. (Universitat Bonn)
Takeda, Masayoshi (Tohoku University)
Teufl, Elmar (Graz University of Technology)
Virag, Balint (University of Toronto)
van den Berg, Michiel (University of Bristol)

Celestial Mechanics
April 17–22, 2004

Organizers:

Florin Diacu (University of Victoria)

Donald Saari (University of California, Irvine)



The programme of the workshop consisted of 45-minute talks followed by 15 minutes of discussions. Often those discussions had been continued in the evening in smaller groups. Objectives of the workshop included:
1. Use the recent advances in variational approaches toward finding new orbits and new properties of celestial mechanics.
2. Explore the interactions between theoretical and applied celestial mechanics in the broadest sense including relating the slingshot effect of triple approaches in the theory of singularities with that of fuel-free techniques of accelerating space ships, a better understanding of the the stable and unstable manifold aspects of the n-body problem and how the present techiques can help finding better space-ship routes in the solar system, and stimulating collaboration between researchers involved in the numerical and the theoretical aspects of the field.
3. Understand the effects of the Aubrey-Mather theory on celestial mechanics.
4. Stimulate general advances in dynamical systems and chaos theory, and in particular towards understanding the Arnold diffusion mechanism and solving Arnold's conjecture.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5012/

Participants:

Albouy, Alain (IMCCE, France)
Belbruno, Ed (Princeton University)
Buck, Gregory (Saint Anselm College)
Chenciner, Alain (IMCCE, France)
Corbera, Montserrat (Universitat de Vic)
Cushman, Richard (Utrecht, Holland & U of Calgary)
Diacu, Florin (University of Victoria)
Gerver, Joseph (Rutgers)
Hampton, Marshall (University of Minnesota)
Kotsireas, Ilias (University of Western Ontario)
Lacomba, Ernesto (UAM-I, Mexico)
Llibre, Jaume (Universitat Autònoma de Barcelona)
McCord, Chris (University of Cincinnati)
Meyer, Kenneth (University of Cincinnati)
Montgomery, Richard (UC-Santa Cruz)
Offin, Dan (Queen's University)
Palacian, Jesus (Universidad Publica de Navarra)
Perez, Ernesto (UAM-I, Mexico)
Roberts, Gareth (College of the Holy Cross, USA)
Saari, Donald (UC-Irvine)
Santoprete, Manuele (UC-Irvine)
Xia, Zhihong (Jeff) (Northwestern University)
Yanguas, Patricia (Universidad Publica de Navarra)

BIRS Workshop in Creative Scientific Writing
April 17–22, 2004

Organizers:

Marjorie Senechal (Smith College)

Chandler Davis (University of Toronto)

The need to create a poetic-dramatic-narrative literature around mathematics is widely acknowledged by mathematicians and non-mathematicians alike. Yet creative writing about the content of mathematics is extremely rare, and creative writing about the act of mathematical creation even rarer. Despite the lively current interest in mathematics on the part of the non-scientific public, much creative writing in and about mathematics today reinforces the insider/outsider divide. The entrenched presupposition that artistic creation is unrelated to mathematical thought still endures, though some writers are struggling against this bias in various ways. Any effort to address these daunting challenges is necessarily experimental. We were encouraged by the statement on the Banff Centre's website, promising "freedom to experiment, with the knowledge that we learn from our failures as well as our successes. It is hoped that everyone will feel comfortable taking risks and challenging assumptions, creating new and unlikely alliances...."

The BIRS's April 2004 workshop brought together mathematicians and non-mathematicians actively engaged in creative writing related to mathematics. We deliberately mixed genres -- exposition, biography, poetry, theatre, journalism, fiction and nonfiction -- in the expectation that the mix proved stimulating.

All workshop participants seriously engaged in a writing project consonant with our theme, willing to discuss some of their work-in-progress, and willing to subject their writing to others' reactions. Everyone was expected to criticize and be criticized. We also urged participants to circulate some of their work (published or unpublished) well in advance of the meeting in Banff. In addition to stimulating discussion. This was an excellent way for participants to introduce themselves to one another.

We were working closely with Carol Holmes, Director of the Banff Program in Writing and Publishing, to adapt and incorporate some of their successful strategies. Part of each day would be spent on group activities, part on presentations and discussion of work-in-progress, and part unscheduled, to allow time for writing. We also explored the problem of finding outlets for the kind of creative writing we were trying to encourage: for example, ways of identifying and educating agents and publishers, and also what contributions The Mathematical Intelligencer might make.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5555/

Participants:

Abate, Marco (Universita di Pisa)
Brandts, Wendy
Davis, Chandler (University of Toronto)
Diacu, Florin (University of Victoria)
Granville, Andrew (Universite de Montreal)
Granville, Jennifer (Ohio University)
Grosholz, Emily (The Pennsylvania State University)
Hansen, Vagn L. (Technical University of Denmark)
Holmes, Philip (Princeton University)
Maddow, Ellen (The Talking Band)
Moody, Robert (University of Alberta)
Priestley, William McGowen (University of the South)
Senechal, Marjorie (Smith College)
Suri, Manil (University of Maryland Baltimore County)
Tasic, Vladimir (University of New Brunswick)
Thomas, Robert (University of Manitoba)
Tuffley, Chris (UC-Davis)
Wali, Kameshwar (Syracuse University)
Zwicky, Jan (University of Victoria)

Microeconometrics of Spatial and Grouped Data
April 24–29, 2004

Organizers:

Thomas Lemieux (Department of Economics, UBC)

David Card (University of California, Berkeley)

The objective of the workshop was to bring together a group of applied economists and econometricians who share a common interest for economic problems in which the group or spatial dimension play an important role. Each of the two groups would bring a unique expertise on these issues. The contribution of the applied researchers presented the economic models and the complex data sets they needed to use to estimate these models. The econometricians presented innovative research showing how standard estimation and inference procedures could be adapted to settings where group or spatial effects are important. The presentations concentrated in the morning to leave enough time for intensive but free exchanges in the afternoon. The hope was that applied researchers come out of the workshop with a much better sense of which econometric tools could be used in their research given the complex nature of the underlying data. By contrast, econometricians would have a unique opportunity to see the types of models and data being used in cutting-edge empirical research. This suggested interesting avenues for their future research. One final objective of the workshop was to encourage new joint research projects between participants, and in particular between applied researchers and econometricians.

The model for this particular workshop was a Summer Symposium that David Card and Daniel McFadden organized on quasi-experimental methods at Berkeley in August 1999. This particular symposium brought together a group of applied economists and econometricians interested in this particular topic. The Banff International Research Station provided a unique opportunity to apply this successful model to new econometric and applied issues that have emerged since 1999.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5036/

Participants:

Anderson, Siwan (University of British Columbia)
Battistin, Erich (Institute for Fiscal Studies)
Boozer, Michael (Yale University)
Bugamelli, Matteo (Bank of Italy)
Card, David (UC-Berkeley)
Cipollone, Piero (Bank of Italy)
Clark, Damon (UC-Berkeley)
Coelli, Michael (University of British Columbia)
Duflo, Esther (MIT)
Firpo, Sergio (University of British Columbia)
Friesen, Jane (Simon Fraser University)
Graham, Bryan (Harvard University)
Ichino, Andrea (European University Institute)
Kling, Jeffrey (Princeton University)
Krauth, Brian (Simon Fraser University)
Lee, David (UC-Berkeley)
Lemieux, Thomas (University of British Columbia)
Martorell, Paco (UC-Berkeley)
McEwan, Patrick (Wellesley College)
Miguel, Edward (UC-Berkeley)
Milligan, Kevin (University of British Columbia)
Moretti, Enrico (UCLA)
Oreopoulos, Philip (University of Toronto)
Riddell, Craig (University of British Columbia)
Rothstein, Jesse (Princeton University)
Sakata, Shinichi (University of British Columbia)
Verhoogen, Eric (UC-Berkeley)

Mathematical Structures in Economic Theory and Econometrics
May 1–6, 2004

Organizers:

Ivar Ekeland (University of British Columbia)

Pierre-Andre Chiappori (University of Chicago)

In the past years, progress in economic theory and econometrics had relied on increasingly sophisticated mathematical tools. Principal-agent problems are typical of optimization under asymmetric information. The principal submits a contract, which the agent may accept or refuse. There are several types of agents, and agents of different types have different tastes. The principal does not know the type of the agents (it knows only the distribution of types), and must therefore deal with the fact that agents may lie to her about their type. In other words, contracts must be drawn in such a way that no agent has an incentive to lie about his type.

Such incentive-compatible contracts are well understood in the case where the type is one-dimensional. When there are several parameters describing the type, the mathematical situation is much more complicated. In fact, one runs into problems in the calculus of variations with global convexity constraints: instead of minimizing an integral criterion over all functions satisfying some boundary condition, one minimizes over convex functions only.

Some other current problems we discussed in this workshop were Economic geography, Hedonic models in econometrics, Analysis of demand functions, and Collective behaviour in economics

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5536/

Participants:

Ahmad, Najma (University of Toronto)
Chiappori, Pierre-Andre (University of Chicago)
Dana, Rose-Anne (University of Paris-Dauphine)
Ekeland, Ivar (University of British Columbia)
Guesnerie, Roger (College de France, Paris)
Jara, Pedro (PSE-EHESS, Universidad de Chile)
Lazrak, Ali (University of British Columbia)
Matzkin, Rosa (Northwestern University)
McCann, Robert (University of Toronto)
Mossay, Pascal (Universidad de Alicante)
Nesheim, Lars (University College London)
Oberman, Adam (Unviersity of Texas)
Pakzad, Reza (PIMS, University of British Columbia)
Peters, Mike (University of British Columbia)
Scott, L. Ridgway (University of Chicago)
Shneyerov, Art (University of British Columbia)
Trokhimtchouk, Maxim (University of Toronto)
Wooders, Myrna (University of Warwick)

Singular Cardinal Combinatorics
May 1–6, 2004

Organizers:

Claude Laflamme (University of Calgary)
Matthew Foreman (University of California-Irvine)
Stevo Todorcevic (University of Toronto/ CNRS Paris)

Set Theory is not only one of the areas of mathematics where the Axiom of Choice is very widely utilized, but also an area of mathematics which systematically searches for structure that is independent of the axiom. Since the mid 1980's there has been increased recognition in Set Theory of the existence of Natural Structure: structure that may require the Axiom of Choice to prove its existence, but is independent of the choices made. This structure includes natural stationary sets, natural ideals and the existence of previously unstudied objects such as scales. Much of this natural structure is centered around a connected body of work that can be labeled "singular cardinal combinatorics".

Set theorists from around the world met at BIRS to discuss Singular Cardinal Combinatorics. The various communities in Europe, Israel, Japan, Canada and the United States have often worked independently; in some cases with remarkably little communication. The workshop gave participants the opportunity to share their results and allow cross-fertilization between the various groups.

During the workshop, several important new results were announced and explained, and there were problem sessions held (some with significant amounts of prize money attached to particular problems). To summarize the direction of the conference, an annotated collection of representative problems with some referenceswe was present at the report.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5523/

Participants:

Abraham , Uri (Ben Gurion University of the Negev)
Asperó , David (University of Bristol)
Bagaria , Joan (University of Barcelona)
Cummings , James (Carnegie-Mellon University)
Dzamonja , Mirna (University of East Anglia)
Eisworth , Todd (University of Northern Iowa/Cedar Falls)
Foreman, Matthew (UC-Irvine)
Gitik , Moti (School of Mathematical Sciences)
Hajnal , Andras (Rutgers)
Ishiu , Tetsuya (University of Kansas)
Kojman , Menachem (Ben Gurion University of the Negev)
Larson, Jean (University of Florida)
Liu, Andreas (UC-Berkeley)
Magidor , Menachem (Einstein Institute of Mathematics)
Martinez , Juan Carlos (University of Barcelona)
Mitchell, William (University of Florida)
Schimmerling, Ernest (Carnegie Mellon University)
Shioya , Masahiro (University of Tsukuba)
Steel, John (University of California)
Thompson , Katherine (Carnegie Mellon University)
Todorcevic, Stevo (University of Toronto/ CNRS, Paris)
Welch, Philip (University of Bristol)
Woodin, W. Hugh (University of California)

Knots and their Manifold Stories
May 8–13, 2004

Organizers:

Orr Kent (Indiana University)
Tim Cochran (Rice University)
Dale Rolfsen (University of British Columbia)

A confluence of several strong currents in mathematics has invigorated knot theory and ancillary areas of 3 and 4-dimensional manifolds.

This workshop brought together a multidisciplinary community to investigate the connections between what at one time seemed disparate areas of mathematical research. The underlying root and impetus has been knot theory. Numerous questions, both classical and modern have arisen. Among these are the four-dimensional topological surgery conjecture, which has been long connected to classical knot theory, the knot concordance problem, the classification of classical knot groups, classification of four dimensional homology cobordism, computation of localization and completion in homotopy theory, the L-theory of localized rings, the classification of knots and three manifolds via finite type and quantum invariants, classical interpretations of these modern invariants, and numerous other classical problems in knots and manifold theory, high and low dimensional.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5037/

Participants:

Cha, Jae Choon (Information and Communications University, Korea)
Chang, Stanley (Wellesley College)
Clay, Adam (University of British Columbia)
Cochran, Tim (Rice University)
Crowley, Diarmuid (Penn State University)
Denecke, Klaus (Potsdam University)
Fenn, Roger (University of Sussex)
Friedl, Stefan (University of Munich)
Gee, Carol (Rice University)
Gilmer , Patrick (Louisiana State University)
Gordon, Cameron (University of Texas)
Harvey, Shelly (MIT)
Heap, Aaron (Rice University)
Hempel, John (Rice University)
Kania-Bartoszynska, Joanna (Boise State University and National Science Foundation)
Kim, Taehee (Rice University)
Klein, John (Wayne State University)
Krushkal, Slava (University of Virginia/ Microsoft Research)
Leidy, Constance (Rice University)
Levine, Jerome (Brandeis University)
Linnell, Peter (Virginia Tech)
Melvin, Paul (Bryn Mawr College)
Orr, Kent (Indiana University)
Ranicki, Andrew (The University of Edinburgh)
Rhemtulla, Akbar (University of Alberta)
Rolfsen, Dale (University of British Columbia)
Schneiderman, Rob (Courant Institute)
Sheiham, Des (International University Bremen)
Stanford, Ted (New Mexico State University)
Watson, Liam (University of British Columbia)
Yurasovskaya, Ekaterina (University of British Columbia)
Zvengrowski, Peter (University of Calgary)

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

Organizers:

Kung-Ching Chang (Peking University)
Jingyi Chen (University of British Columbia)
Changfeng Gui (University of Connecticut)
Paul Rabinowitz (University of Wisconsin, Madison)

The subject has come of age in the last forty years, and a number of surveys and monographs have described much of the progress. A first objective of the workshop was obviously to discuss some of the recent developments while emphasizing new applications to nonlinear problems.

However, more often than not, progress is driven by specific applications. Novel variational techniques developed by groups or individuals concerned with these applications, do not make their way to others who may be using similar variational methods but on different type of problems. This workshop brought together experts and young researchers working in different areas of variational methods. These areas included abstract variational methods such as Novikov Morse theory and nonsmooth critical point theory, geometric PDEs, and nonlinear problems from applied fields such as superconductivity and phase transitions. So the second objective of the workshop was to provide an opportunity to exchange ideas from abstract theories and applications so that novel variational methods can find more applications and new theories can be developed. Below were the main themes of the workshop:

1. General theories: Novikov Morse theory and nonsmooth critical point theory
2. Variational methods in phase transitions, vortex dynamics and superconductivity
3. Variational methods in Geometry

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5033/

Participants:

Alama, Stanley (McMasterUniversity)
Bartsch, Thomas (University of Giessen)
Bates, Peter (Michigan State University)
Bisgard, Jim (University of Wisconsin-Madison)
Bolotin, Sergey (University of Wisconsin)
Buffoni, Boris (Federal Swiss Institute of Technology-Lausanne)
Burchard, Almut (University of Virginia)
Ekeland, Ivar (PIMS, University of British Columbia)
Esteban, Maria (Universite Paris IX-Dauphine)
Farber, Michael (University of Durham)
Ghoussoub, Nassif (University of British Columbia)
Glotov, Dmitry (Purdue University)
Gui, Changfeng (University of Connecticut)
Hajaiej, Hichem (University of Virginia)
Jerrard, Robert (University of Toronto)
Ji, Min (Chinese Academy of Sciences)
Jiang, Meiyue (Peking University)
Kang, Xiaosong (University of Toronto, Fields)
Li, Congming (University of Colorado)
Li, Yanyan (Rutgers University)
Long, Yiming (Nankai University)
McKenna, Joe (University of Connecticut)
Montero, Alberto (McMaster University)
Nirenberg, Louis (Courant Institute)
Rabinowitz, Paul (University of Wisconsin, Madison)
Ren, Xiaofeng (Utah State University)
Sere, Eric (Universite Paris IX-Dauphine)
Serfaty, Sylvia (Courant Institute)
Speicher, Regina (University of Connecticut)
Sternberg, Peter (Indiana University)
Stredulinsky, Ed (University of Wisconsin-Richland)
Wang, Zhi-Qiang (Utah State University)
Wei, Juncheng (Chinese University of Hong Kong)
Zhang, K. W. (University of Sussex)

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

Organizers:

Torsten Möller (Simon Fraser University)
Bernd Hamann (University of California-Davis)
Robert Russell (Simon Fraser University)

In the last 15 years the profound impact of scientific computing upon virtually every area of science and engineering has been well established. The increasing complexity of the underlying mathematical models has also highlighted the critical role to be played by Scientific Visualization. It therefore comes as no surprise that Scientific Visualization is one of the most active and exciting areas of Mathematics and Computing Science, and indeed one which is only beginning to mature.

The importance of more rigorous mathematical approaches is becoming self apparent. At the last few Siggraph and Visualization conferences (the main conferences in the fields of graphics and visualization), an increasing number of mathematically oriented tutorials have been offered and received an enthusiastic reception.

A primarily objective of the workshop was to gather together the main researchers in the mathematical areas relevant to the recent advances in order to discuss the research challenges facing this field in the next several years.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5043/

Participants:

Alexa, Marc (Technische Universität Darmstadt)
Attali, Dominique (Laboratoire LIS, ENSIEG, Domaine Universitaire)
Banks, David C. (Florida State University)
Bremer, Timo (UC-Davis)
Carr, Hamish (University of British Columbia)
Ebling, Julia (University of Kaiserslautern)
Edelsbrunner, Herbert (Duke University)
Entezari, Reza (Simon Fraser University)
Hamann, Bernd (UC-Davis)
Hotz, Ingrid (UC-Davis)
Johnson, Chris (University of Utah)
Joy, Ken (UC-Davis)
Kirby, Mike (University of Utah)
Klaus, Mueller (State University of New York, Stony Brook)
Livnat, Yarden (University of Utah)
Ma, Kwan-Liu (UC-Davis)
Macdonald, Colin (Simon Fraser University)
Machiraju, Raghu (The Ohio State University)
Mascarenhas, Ajith (University of North Carolina, Chapel Hill)
Munzner, Tamara (University of British Columbia)
Möller, Torsten (Simon Fraser University)
Nielson, Gregory M. (Arizona State University)
North, Stephen (AT&T Labs)
Pascucci, Valerio (Lawrence Livermore National Laboratory)
Polthier, Konrad (Zuse Institute Berlin)
Prohaska, Steffen (Zuse Institute Berlin)
Quak, Ewald (SINTEF ICT)
Russell, Robert (Simon Fraser University)
Shamir, Ariel (The Interdisciplinary Center, Herzliya)
Silva, Claudio T. (University of Utah)
Snoeyink, Jack (University of North Carolina, Chapel Hill)
Taubin, Gabriel (Brown University)
Tricoche, Xavier (University of Utah)
Weiskopf, Daniel (University of Stuttgart)
Whitaker, Ross T. (University of Utah)
Zhang, Richard (Hao) (Simon Fraser University)
Zhukov, Leonid (CalTech/Yahoo! Research Labs)
van Wijk, Jack (Technische Universiteit Eindhoven)

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

Organizers:

Michael Baake (Institut fuer Mathematik)
David Damanik (Caltech)
Ian Putnam (University of Victoria)
Boris Solomyak (University of Washington)

One of the main features of quasicystalline structures is that they are highly ordered, and hence quite different from random structures, yet they lack global translation invariance which sets them apart from crystalline structures. This type of intermediate behaviour can be studied from different viewpoints, for example, ergodic theory, combinatorics, and operator theory. During the last 10 years, it has become obvious that methods from ergodic theory are very suitable to explore and prove properties of perfectly ordered structures such as tilings and point sets obtained from either the projection method or an inflation procedure. Questions ranging from the general concept of symmetry to the spectral nature of the structures and their associated operators in applications find a universal frame in an ergodic theory setting. We expect that the forthcoming activities in this direction will have an important impact on the classification and taxonomy of ordered structures between (fully) periodic and amorphous, and there is also a very natural link to combinatorial methods. The aim of this workshop was to bring people from the various mathematical disciplines together and to exchange the state of the art as well as to communicate open problems.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5001/

Participants:

Akiyama, Shigeki (Niigata University)
Baake, Michael (Universität Bielefeld)
Barge, Marcy (Montana State University)
Berthe, Valerie (LIRMM, Montpellier)
Carlsen, Toke (University of Copenhagen)
Cassaigne, Julien (IML-CNRS, Marseille)
Damanik, David (Caltech)
Diamond, Beverly (College of Charleston)
Durand, Fabien (Universite de Picardie Jules Verne)
Edson, Marcia (University of North Texas)
Fisher, Benji (Boston College)
Frank, Natalie (Vassar College)
Gambaudo, Jean-Marc (Universite de Bourgogne)
Giordano, Thierry (University of Ottawa)
Goncalves, Daniel (University of Victoria)
Gouere, Jean-Baptiste (Universite Claude Bernard Lyon 1)
Grimm, Uwe (The Open University, UK)
Gähler, Franz (Universität of Stuttgart)
Holton, Charles (University of Texas at Austin)
Huck, Christian (Universität Bielefeld)
Hunton, John (University of Leicester)
Kwapisz, Jaroslaw (Montana State University)
Lee, Jeong-Yup (University of Alberta)
Lenz, Daniel (Technische Universitat Chemnitz)
Martensen, Brian (University of Texas)
Moody, Robert (University of Alberta, BIRS)
Naumis, Gerardo (Instituto de Fosica, UNAM)
Phillips, N. Christopher (University of Oregon)
Pleasants, Peter A. B. (University of Queensland)
Putnam, Ian (Univesity of Victoria)
Radin, Charles (University of Texas, Austin)
Sadun, Lorenzo (University of Texas)
Siegel, Anne (IRISA)
Sing, Bernd (Universität Bielefeld)
Sirvent, Victor (University of Simon Bolivar)
Skau, Christian (Norwegian University of Science and Technology)
Solomyak, Boris (University of Washington)
Starling, Charles (University of Victoria)
Strungaru, Nicolae (University of Alberta)
Wang, Yang (Georgia Institute of Technology)
Yi, Inhyeop (George Washington University)

Semimartingale Theory and Practice in Finance
June 5–10, 2004

Organizers:

Tom Hurd (McMaster University)
Thaleia Zariphopoulou (University of Texas-Austin)
Philip Protter (Cornell University)
Lane Hughston (King's College London)

The theme and title of this BIRS workshop was inspired by the wish to celebrate the serendipitous union of the abstraction and elegance of semimartingales, the rich and general class of continuous and discrete-time stochastic processes, with the hard realism of financial markets. Who could imagine that the mathematical foundations set down in the twentieth century by Kolmogorov, Doob, Ito, Meyer and others would find such a close fit with reality? It seems fitting that the first BIRS workshop on financial mathematics, which brought together leading theorists and young researchers from Canada, the USA, and abroad, should concentrate on the mathematical foundations of the subject.

The subject of financial mathematics takes as its basic objects of study the *primary financial markets*: equity (stocks), fixed income (sovereign bonds), credit risk (corporate bonds), foreign exchange, and commodities. Built on the primary asset classes, we also have the auxiliary markets that trade contracts written on these primary assets. These are the *derivatives and options* known as puts, calls, forwards, futures, swaps, plus the multitude of "exotic options". The range of the subject doesn't stop there: current developments are being driven by the need to extend the principles of finance to a host of new markets that are arising around the globe, including, for example, emissions trading, life insurance, reinsurance, energy, weather, and hedge funds. Researchers in our workshop looked into a variety of subproblems.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5032/

Participants:

Acciaio, Beatrice (University of Perugia)
Albanese, Claudio (Imperial College London)
Almgren, Robert (University of Toronto)
Becherer, Dirk (Imperial College London)
Berndt, Antje (Cornell University)
Biagini, Sara (University of Perugia and Scuola Normale)
Brendle, Simon (Princeton University)
Carmona, Rene (Princeton University)
Cheridito, Patrick (Princeton University)
Cont, Rama (Ecole Polytechnique)
Davison, Matt (University of Western Ontario)
Di Graziano, Guiseppe (Cambridge University)
Eberlein, Ernst (University of Freiburg)
Frittelli, Marco (Università di Firenze)
Grasselli, Matheus (McMaster University)
Guo, Xin (Cornell University)
Heath, David (Carnegie Mellon University)
Henderson, Vicky (Princeton University)
Hobson, David (University of Bath)
Hughston, Lane (King's College London)
Hugonnier, Julien N. (HEC Montreal)
Hurd, Tom (McMaster University)
Karatzas, Ioannis (Columbia University)
Labbe, Chantal (University of Waterloo)
Macrina, Andrea (King's College London)
Melnikov, Alexander (University of Alberta)
Musiela, Marek (BNP Paribas UK)
Pistorius, Martijn R. (King's College London)
Rafailidis, Avraam (King's College London)
Rindisbacher, Marcel (University of Toronto)
Schachermayer, Walter (Vienna University of Technology)
Schoenbucher, Philipp (ETH-Zentrum)
Schweizer, Martin (ETH-Zentrum)
Seco, Luis (University of Toronto)
Shreve, Steven E. (Carnegie Mellon University)
Tompaidis, Stathis (University of Texas-Austin)
Tourin, Agnes (McMaster University)
Ware, Tony (University of Calgary)
Zariphopoulou, Thaleia (University of Texas- Austin)
Zervos, Mihail (King's College London)

New Horizons in String Cosmology
June 12–17, 2004

Organizers:

James Cline (McGill University)
Robert Brandenberger (Brown University)
Steve Giddings (UC-Santa Barbara)
Brian Greene (Columbia University)
Rob Myers (Perimeter Institute)
Gordon Semenoff (University of British Columbia)

Because of the aforementioned advances, issues in string cosmology have attracted the attention of string theorists who would not otherwise have attempted to address cosmology, as well as field theorists whose expertise is more on the cosmological issues themselves. Although the main focus of the workshop was on the mathematical and string theoretic aspects of the subject, it is worthwhile to have input from people in both groups, since the ultimate aim was to make a connection with observable physics. The purpose of the workshop was therefore to provide an opportunity to discuss the current problems and issues in string cosmology, both at the technical level and at a more conceptual level.

The Workshop began by providing overviews of the latest progress in areas of string cosmology and followed by forums to discuss its key problems. One of the goals of the workshop was to try to move closer to having a set of tools or a framework within which one might hope to carry out more rigorous calculations. Despite the remarkable surge of interest amongst both string theorists and cosmologists in exploring the potential overlap of these two fields, and the variety of new ideas which have been generated, the field is still in its infancy and it requires refinement and clarification of the methodology.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5021/

Participants:

Adams, Allan (Stanford University)
Albrecht, Andreas (University of California)
Battefeld, Thorsten (Brown University)
Bond, Richard (CITA and University of Toronto)
Bousso, Raphael (Harvard University)
Brandenberger, Robert (Brown University)
Burgess, Cliff (McGill University)
Cline, James (McGill University)
Copeland, Edmund (University of Sussex)
Fischler, Willy (University of Texas)
Giddings, Steve (UC-Santa Barbara)
Greene, Brian (Columbia University)
Gregory, Ruth (University of Durham)
Harvey, Jeff (University of Chicago)
Horava, Petr (University of California)
Jackson, Mark (Columbia University)
Kallosh, Renata (Stanford University)
Kaloper, Nemanja (University of California)
Khoury, Justin (Columbia University)
Kofman, Lev (Canadian Inst. for Theoratical Astrophysics)
Larsen, Finn (Unversity of Michigan)
Linde, Andrei (Stanford University)
Liu, Hong (MIT)
Lowe, David (Brown University)
Marolf, Don (UC-Santa Barbara)
Myers, Robert (Perimeter Institute)
Ovrut, Burt (University of Pennsylvania)
Peet, Amanda (University of Toronto)
Quevedo, Fernando (Cambridge University)
Randall, Lisa (Harvard University)
Rozali, Moshe (University of British Columbia)
Schalm, Koenraad (Columbia University)
Semenoff, Gordon (University of British Columbia)
Servant, Géraldine (Enrico Fermi Institute)
Shenker, Stephen (Stanford University)
Shiu, Gary (University of Wisconsin)
Silverstein, Eva (Stanford Linear Accelerator Center)
Steinhardt, Paul (Princeton University)
Stoica, Horace (McGill University)
Tye, Henry (Cornell University)
Weltman, Amanda (Columbia University)
van Raamsdonk, Mark (University of British Columbia)

Advances in Complexity Theory
July 4–8, 2004

Organizers:

Valentine Kabanets (Simon Fraser University)
Stephen Cook (University of Toronto)
Arvind Gupta (Simon Fraser University)
Russell Impagliazzo (UC-San Diego)
Madhu Sudan (MIT)
Avi Wigderson (Institute for Advanced Study, Princeton)

Computational Complexity Theory is the field that studies the efficiency of computation. Its major goals are to find efficient algorithms for natural problems in natural computational models, or to show that no efficient solutions exist. The famed "P versus NP" problem (one of the seven open problems of the Clay Institute) is the central problem of this field and, despite three decades of active research, this problem has eluded resolution. However, during this period, our understanding of efficient computation has improved significantly through a number of concepts, techniques and results.

The goal of this workshop was to examine these recent achievements in complexity theory, exchange ideas, formulate open problems, and identify new directions of research.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5100/

Participants:

Akavia, Adi (MIT)
Allender, Eric (Rutgers University)
Beame, Paul (University of Washington)
Ben-Sasson, Eli (Radcliffe Institute for Advanced Study)
Bogdanov, Andrej (UC-Berkeley)
Braverman, Mark (University of Toronto)
Buresh-Oppenheim, Josh (University of Toronto)
Buss, Sam (UC-San Diego)
Cleve, Richard (University of Calgary)
Cook, Stephen (University of Toronto)
Dinur, Irit (UC-Berkeley)
Fortnow, Lance (University of Chicago)
Gal, Anna (University of Texas-Austin)
Gupta, Arvind (Simon Fraser University)
Guruswami, Venkatesan (University of Washington)
Impagliazzo, Russell (UC-San Diego)
Kabanets, Valentine (Simon Fraser University)
Kapron, Bruce (University of Victoria)
Kindler, Guy (DIMACS)
Kolokolova, Antonina (University of Toronto)
McKenzie, Pierre (University of Montreal)
Morioka, Tsuyoshi (University of Toronto)
Pitassi, Toni (University of Toronto)
Pudlak, Pavel (Institute of Mathematics, Prague)
Rackoff, Charles (University of Toronto)
Raz, Ran (Weizmann Institute of Science)
Regev, Oded (Tel-Aviv University)
Reingold, Omer (Weizmann Institute)
Saks, Michael (Rutgers University)
Segerlind, Nathan (Institute for Advanced Study)
Shaltiel, Ronen (Weizmann Institute of Science)
Skelley, Alan (University of Toronto)
Srinivasan, Venkatesh (University of Victoria)
Sudan, Madhu (MIT)
Szegedy, Mario (Rutgers University)
Trevisan, Luca (UC-Berkeley)
Umans, Chris (Caltech)
Watrous, John (University of Calgary)
Wigderson, Avi (Institute for Advanced Study, Princeton)
Zuckerman, David (University of Texas-Austin)
van Melkebeek, Dieter (University of Wisconsin)

Convex Geometric Analysis
July 10–15, 2004

Organizers:

Nicole Tomczak-Jaegermann (University of Alberta)
Vitali Milman (Tel Aviv University)
Elisabeth Werner (Case Western Reserve University)

The main goal of the workshop was to bring researchers from different fields of Convex Geometric Analysis to exchange new ideas, to inform on new results and to consider new directions essential for further developments and applications. This goal was achieved and overachieved. We brought together senior experts and we ensured the participation of a significant number of young researchers - in fact, more than a half of all talks were given by people from this latter group. The subject was treated in a very broad sense, and some leading people from related fields (such as Classical Convexity and Asymptotic Combinatorics) were invited and contributed to the success of the meeting. By the request of some participants we also had an informal seminar lecture which attracted many participants and continued much more than an hour.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5014/

Participants:

Alesker, Semyon (Tel Aviv University)
Anisca, Razvan (Texas A&M University)
Artstein, Shiri (Tel Aviv University)
Ball, Keith (University College London)
Barthe, Franck (Universite Toulouse III)
Colesanti, Andrea (University of Florence)
Cordero-Erausquin, Dario (Universite de Marne la Vallee)
Gordon, Yehoram (Technion)
Guedon, Olivier (University Paris 6)
Hug, Daniel (Freiburg University)
Johnson, Bill (Texas A & M University)
Klartag, Bo'az (Tel Aviv University)
Koenig, Hermann (Kiel University)
Koldobsky, Alexander (University of Missouri)
Krivelevich, Michael (Tel Aviv University)
Latala, Rafal (Warsaw University)
Lindenstrauss, Joram (Hebrew University)
Litvak, Alexander (University of Alberta)
Ludwig, Monika (TU Wien)
McCann, Robert (University of Toronto)
Milman, Emanuel (Weizmann Institute)
Milman, Vitali (Tel Aviv University)
Naor, Assaf (Microsoft Research)
Oleszkiewicz, Krzysztof (Warsaw University)
Pajor, Alain (University Marne-la-Vallee)
Pelczynski, Aleksander (Institute of Math, Polish Academy of Sciences)
Pisier, Gilles (Texas A&M University/ Paris 6)
Pivovarov, Peter (University of alberta)
Reisner, Shlomo (University of Haifa)
Rudelson, Mark (University of Missouri)
Schechtman, Gideon (Weizmann Institute)
Schneider, Rolf (Freiburg University)
Schuett, Carsten (Kiel University)
Sodin, Alexander (Tel Aviv University)
Szarek, Stanislaw (Case Western Reserve University/ Paris 6)
Tomczak-Jaegermann, Nicole (University of Alberta)
Vershynin, Roman (UC-Davis)
Vu, Van (UC-San Diego)
Yang, Deane (Polytechnic University)
Zhang, Gaoyong (Polytechnic University)

Modeling Protein Flexibility and Motions
July 17–22, 2004

Organizers:

Walter Whiteley (York University)
Michael Thorpe (Arizona State University)
Leslie Kuhn (Michigan State University)

Protein modeling is a 'hot area' connected in important ways to results from the human genome projects as well as important theoretical and medical problems. There are a number of distinct communities working on computer (and mathematical) modeling of protein flexibility, rigidity, and folding, or on simplified and abstracted models with potential applications to these problems. This workshop brought together leading experts as well as current graduate students and post-docs from at least four of these communities: mathematicians working on the rigidity theory for structures; computational geometers working on motions and paths of linkages, polygons, etc.; material scientists modeling rigidity in large molecular configurations; biochemists modeling protein flexing, binding of molecules on proteins, and rigidity as a tool for predicting protein behaviour. The objective was to: (i) summarize the state of the art (as it then exists) for modeling protein flexibility and motions using models such as frameworks, linkages, tensegrity structures, robotics kinematics, etc.; (ii) describe unsolved critical problems about current and potential models (mathematical, computational and biochemical), sorting the potential significance of various problems and potential results; (iii) use some working sessions to explore ways to clarify, resolve or solve these problems and propose priority problems and approaches.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5017/

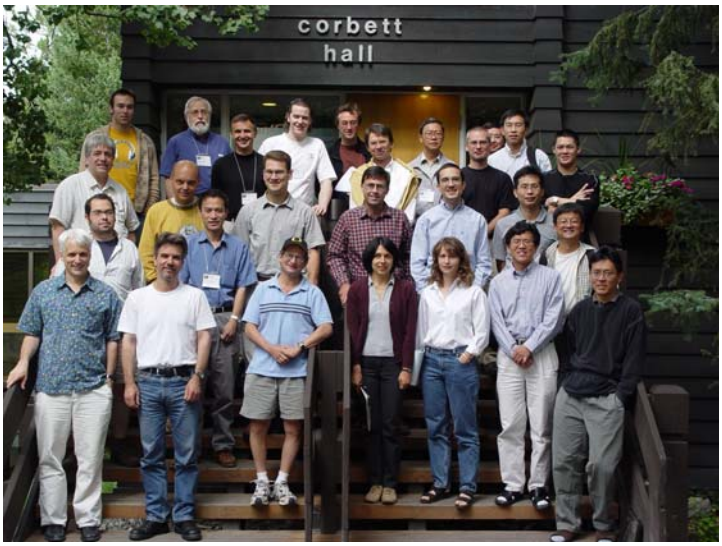
Participants:

Amato, Nancy (Texas A&M University)
Bahar, Ivet (University of Pittsburgh)
Bereg, Sergey (University of Texas, Dallas)
Bezdek, Karoly (University of Calgary)
Borcea, Ciprian (Rider University)
Brock, Oliver (University of Massachusetts Amherst)
Burkowski, Forbes J. (University of Waterloo)
Chubynsky, Mykyta (Arizona State University Tempe)
Connelly, Robert (Cornell University)
Gohlke, Holger (J.W. Goethe-Universitat)
Guest, Simon (University of Cambridge)
Hespenheide, Brandon (Arizona State University, Tempe)
Jackson, Bill (Queen Mary College, University of London)
Jacobs, Don (California State University, Northridge)
Jiguo, Jiang (York University)
Jordan, Tibor (Eotvos University)
Kumar, Sanjay (Children's Hospital Boston, Harvard Medical School)
Lerner, Michael George (University of Michigan)
Mantler, Andrea (UNC-Chapel Hill)
Melnik, Roderick V.N. (Wilfred Laurier University)
Menor, Scott (Arizona State University)
Mousseau, Normand (Université de Montréal)
Rader, Andrew J. (University of Pittsburgh)
Richardson, David (Duke University)
Richardson, Jane (Duke University)
Ros, Lluis (Instutite of Robotics)
Rybnikov, Konstatin (University of Massachusetts)
Sanner, Michel (The Scripps Research Institute)
Servatius, Brigitte (Worcester Polytechnic Institute)
Servatius, Herman (Worcester Polytechnic University)
Sloughter, Maria (CornellUniversity)
Snoeyink, Jack (UNC-Chapel Hill)
Streinu, Ileana (Smith College)
Tay, Tiong-Seng (National University of Singapore)
Thomas, Shawna (Texas A&M University)
Thorpe, Michael (Arizona State University)
Whiteley, Walter (York University)
Whitesides, Sue (McGill University)
Zavodszky, Maria (Michigan State University)
Zuckerman, Daniel (University of Pittsburgh)

Geometric Evolution Equations
July 24–29, 2004

Organizers:

Christine Guenther (Pacific University)
Jingyi Chen (University of British Columbia)
Bennett Chow (UC, San Diego)
Klaus Ecker (Freie Universitaet Berlin)



In view of the continuing spectacular growth and advancement of the field of geometric evolution equations (GEEs for short), a 5-day workshop in the summer of 2004 at BIRS focused in this area presented a unique and timely opportunity to stimulate important new mathematical research and exposition on GEEs.

Methods and techniques which have been developed for one GEE often apply to numerous others. For example the method of P. Li and S.T. Yau for deriving differential Harnack inequalities for the heat equation has been further developed for many GEEs and applied to the analysis of singularity formation. Isoperimetric estimates are now known for many GEEs, both leading to proofs of global existence and convergence and finding applications in singularity theory. Pinching estimates hold for various GEEs; they are central to global existence and convergence theorems in the presence of convexity, and lead to proofs of the convexity of singularity models. Maximum principle and gradient estimates are ubiquitous in the field. There are just a few examples. Such cross-fertilization of methodology, interaction between researchers on different GEEs is crucial, and often leads to new and important advances in the field. In recent years, important advances are happening in many parts of the world. The geographic diversity of the participants brought together in this workshop, facilitated the dissemination of the most recent research ideas and results, which otherwise might not be possible. The atmosphere of the workshop and its surroundings led to new collaborations during the workshop and especially in the years following the workshop.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5008/

Participants:

Buckland, John (Australian National University)
Butscher, Adrian (University of Toronto, Scarborough)
Cao, Xiaodong (Columbia University)
Chau, Albert (Harvard University)
Chen, Jingyi (University of British Columbia)
Chow, Bennett (UC, San Diego)
Chu, Sun-Chin (National Chung Cheng University)
Ecker, Klaus (Freie Universitaet Berlin)
Guenther, Christine (Pacific University)
Gulliver, Robert (University of Minnesota)
Hong, Min-Chun (University of Queensland)
Huisken, Gerhard (Max Planck Institute for Gravitational Physics)
Isenberg, Jim (University of Oregon)
Ivey , Thomas (College of Charleston)
Knopf, Dan (University of Texas, Austin)
Kuwert, Ernst (Albert-Ludwigs-Universitaet Freiburg, Germany)
McCoy, James (Australia National University)
Neves, Andre (Stanford University)
Ni, Lei (UC, San Diego)
Sesum, Natasa (MIT)
Simon, Miles (Albert-Ludwigs-Universitaet Freiburg, Germany)
Sinestrari, Carlo (Università di Roma)
Smoczyk, Knut (Max Planck Institute)
Struwe, Michael (Eidgen Technische Hochschule, Zentrum)
Tam, Luen-Fai (Chinese University of Hong Kong)
Tsai, Dong-Ho (National Tsing Hua University)
White, Brian (Stanford University)

Conformal Geometry
July 31–August 5, 2004

Organizers:

Thomas Branson (University of Iowa)
Michael Eastwood (University of Adelaide, Australia)
McKenzie Wang (McMaster University)

This workshop brought together key researchers from neighbouring fields whose recent work has involved conformal geometry or CR geometry with an aim to stimulate further collaborations in this growing and dynamic area. Ingredients and links between differential geometry, representation theory, geometric analysis, and mathematical physics were explored.

Mathematical topics discussed included Q-curvature and curvature prescription problems, the ambient metric construction, invariant operators, spin geometry, scattering theory, over-determined systems, spectral invariants, and sharp inequalities. Interactions with physics were pursued especially those concerning the functional determinant, the AdS/CFT correspondence, and string theory. This workshop provided an excellent opportunity for communication between geometers, analysts, and physicists.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5006/

Participants:

Alexakis, Spyridon (Princeton University)
Baum, Helga (Humboldt Universität zu Berlin)
Bland, John (University of Toronto)
Branson, Thomas (University of Iowa)
Cap, Andreas (University of Vienna)
Dolan, Louise (University of North Carolina)
Dunajski, Maciej (Cambridge University)
Derdzinski, Andrzej (The Ohio State University)
Eastwood, Michael (University of Adelaide,Australia)
Gover, A. Rod (University of Auckland)
Graham, C. Robin (University of Washington)
Hirachi, Kengo (University of Tokyo)
Hong, Doojin (University of Iowa)
LeBrun, Claude (SUNY-Stony Brook)
Leitner, Felipe (Humboldt University Berlin)
Maschler, Gideon (University of Toronto)
Mason, Lionel (Oxford University)
Matveev, Vladimir (University of Freiburg)
Olafsson, Gestur (Louisiana State University)
Page, Don (University of Alberta)
Peterson, Lawrence (University of North Dakota)
Raske, David (UC-Santa Cruz)
Schmalz, Gerd (Universität Bonn)
Seshadri, Neil (University of Tokyo)
Slovak, Jan (Masaryk University)
Soucek, Vladimir (Charles University, Prague)
Sparling, George (University of Pittsburgh)
Tod, K. Paul (Oxford University)
Ugalde, William (Purdue University)
Villanueva, Alfredo (University of Iowa)
Wang, McKenzie (McMaster University)
Zhang, Genkai (Chalmers University of Technology, Sweden)

Stochastic Processes in Evolutionary and Disease Genetics
August 7–12, 2004

Organizers:

Ellen Baake (University of Greifswald)
Don Dawson (Carleton University)
Warren Ewens (University of Pennsylvania)
Bruce Rannala (University of Alberta)

The meeting was devoted to mathematical aspects of population genetics, a branch of theoretical biology which is concerned with the analysis of the generation, nature, and maintenance of genetic variation within and between biological populations. In its evolutionary aspects it describes the change in the genetic composition of populations under the influence of various evolutionary forces, the most important of which are mutation, selection, recombination, migration and random genetic drift. From the point of view of disease genetics, many diseases are caused by deleterious mutant genes, and the analysis of the variation in a population for the disease and the normal gene is a significant component of this area of research. These two components of the theory have hitherto been somewhat separate. However, recent trends in evolutionary genetics theory (in particular, the change from the prospective to the retrospective view) have brought them together, and one of the aims of this meeting was to further this fusion of two important areas of population genetics.

The meeting covered six main topics ranging from pure mathematical theory to applied human genetics, namely, particle systems, the coalescent, evolutionary population genetics, branching processes, human genetics, and haplotype blocks. Special emphasis was on the manifold connections between these themes.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5015/

Participants:

Baake, Ellen (University of Bielefeld)
Baake, Michael (University of Bielefeld)
Birkner, Matthias (Weierstrass-Institut fuer Angewandte Analysis und Stochastik)
Bull, Shelley (University of Toronto, Samuel Lunenfeld Research Institute)
Chang, Joseph (Yale University)
Clark, Andrew (Cornell University)
Clerget-Darpoux, Francoise (INSERM U535, Hôpital Paul Brousse)
Cox , Ted (Syracuse University)
Daly, Mark (Whitehead Institute)
Dawson, Don (Carleton University)
De, Arkendra (Cornell University)
Donnelly, Peter (Oxford University)
Durrett, Rick (Cornell University)
Elston, Robert (Case Western Reserve University)
Ewens, Warren (University of Pennsylvania)
Fearnhead, Paul (Lancaster University)
Geiger, Jochen (Technische Universität Kaiserslautern)
Gillespie, John (UC-Davis)
Greenwood, Priscilla (Arizona State University)
Griffiths, Robert (University of Oxford)
Jagers, Peter (Chalmers University of Technology)
Joyce, Paul (University of Idaho)
Kim, Yuseob (University of Rochester)
Krone, Steve (University of Idaho)
Kurtz, Tom (University of Wisconsin-Madison)
Limic, Vlada (University of British Columbia)
Luo, Yuqun (Case Western Reserve University)
Möhle, Martin (University of Tübingen)
Nielsen, Rasmus (Cornell University)
Ott, Jurg (Rockefeller University)
Patterson, Nick (Broad Institute, MIT)
Popovic, Lea (University of Minnesota)
Rannala, Bruce (University of Alberta)
Siegmund, David (Stanford University)
Stephens, Matthew (University of Washington)
Stewart, William (University of Washington)
Sturm, Anja (University of British Columbia)
Taylor, Jessie (University of Edinburgh)
Thompson, Elizabeth (University of Washington)
Wakeley, John (Harvard University)
Wakolbinger, Anton (Universität Frankfurt am Main)
Wiuf, Carsten (University of Aarhus)
Yu, Feng (University of British Columbia)

Statistical Science for Genome Biology
August 14–19, 2004

Organizers:

Jennifer Bryan (University of British Columbia)
Sandrine Dudoit (UC-Berkeley)
Mark van der Laan (UC-Berkeley)

The main objective for this workshop was to facilitate the development and dissemination of statistical methods relevant to genome-scale biology, by bringing together leading researchers working at the interface between the biological and mathematical sciences. An important goal was to include statisticians working on different aspects of statistics but all related to genomics. We had intentionally targeted areas ranging from classical statistical genetics, such as the genetic mapping of complex traits, to the emerging area of high throughput gene and protein expression analysis. It was becoming increasingly important for statisticians working in genomics to be aware of the quantitative problems and solutions related to diverse experimental platforms. Biological investigators were taking advantage of opportunities to study a system or process from several angles simultaneously and there is a growing need for quantitative methods to handle disparate data types seamlessly, for example, a holistic analysis based on sequence, expression, and molecular interaction data. An aim of this workshop was to devise appropriate statistical formulations for such analyses, which will expedite the creation and application of sound and powerful statistical methodologies.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5519/

Participants:

Allison, David (University of Alabama at Birmingham)
Birkner, Merrill (UC-Berkeley)
Brumm, Jochen (University of British Columbia)
Bryan, Jennifer (University of British Columbia)
Buhlmann, Peter (ETH Zurich)
Bull, Shelley (University of Toronto)
Bureau, Alexandre (University of Lethbridge)
Carey, Vince (Harvard University)
Dudoit, Sandrine (UC-Berkeley)
Durbin, Blythe (UC-Berkeley)
Fridlyand, Jane (UC-San Fracisco)
Gentleman, Robert (Harvard, Dana Farber)
Hansen, Kasper Daniel (University of Copenhagen)
Holmes, Susan (Stanford University)
Hubbard, Alan (UC-Berkeley)
Joe, Harry (Univerisity of British Columbia)
Jornsten, Rebecka (Rugers University)
Keich, Uri (Cornell University)
Keles, Sunduz (University of Wisconsin, Madison)
Kendziorski, Christina (University of Wisconsin)
Kopciuk, Karen (Alberta Cancer Board/ U of Calgary)
Kustra, Rafal (University of Toronto)
Larkin, Jennie (The Institute for Genomic Research)
Lumley, Thomas (University of Washington)
Marin, Michael (University of British Columbia)
Molinaro, Annette (UC-Berkeley/ NCI)
Newton, Michael (University of Wisconsin)
Pachter, Lior (UC, Berkeley)
Pollard, Katherine S. (UC-Santa Cruz)
Purdom, Elizabeth (Stanford University)
Quackenbush, John (The Institute for Genomic Research)
Rocke, David (UC-Davis)
Rossini, Anthony (University of Washingon)
Ruczinski, Ingo (Johns Hopkins University)
Sinisi, Sandra (UC-Berkeley)
Temple Lang, Duncan (UC-Davis)
Trivedi, Prinal (The University of Alabama at Birmingham)
Yang, Yee Hwa (UCSF)
van der Laan, Mark (UC-Berkeley)

Dynamics, Control and Computation in Biochemical Networks
August 21–26, 2004

Organizers:

Brian Ingalls (University of Waterloo)
Leon Glass (McGill University)
John Reinitz (Stony Brook University)
Eduardo Sontag (Rutgers University)
Erik Winfree (California Institute of Technology)

Cells and organisms have evolved elaborate mechanisms to carry out their basic functions. Networks of biochemical reactions are responsible for processing environmental signals, inducing the appropriate cellular responses and sequence of internal events. The overall molecular algorithms carried out by such networks are as yet poorly understood. In Recent years, remarkable advances in elucidating the components of these networks have been witnessed due to technological achievements. These advances have confronted the biological sciences with massive amounts of data that require huge computational resources. The field of bioinformatics has developed sophisticated computer-based algorithms which all cellular and molecular biologists now use to identify and analyze DNA and protein sequences.

This workshop was designed to address a range of questions that goes beyond the development of algorithms for the searching and analysis of genomic and protein data bases. It brought together mathematicians, physical scientists, engineers, computer scientists, and biological scientists to address fundamental questions concerning the computations that are carried out within cellular and genetic biological networks.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5550/

Participants:

Bolouri, Hamid (Institute for Systems Biology)
Chaves, Madalena (Aventis)
Davidson, Carla (University of Calgary)
Dawes , Adriana (University of British Columbia)
Doyle, Frank (UC-Santa Barbara)
Edwards, Roderick (University of Victoria)
El-Samad, Hana (UC-Santa Barbara)
Elowitz, Michael (California Institute of Technology)
Elston, Timothy (University of North Carolina)
Enciso, German (Rutgers, The State University of New Jersey)
Endy, Drew (Massachusetts Institute of Technology)
Ferrell, James (Stanford University)
Gedeon, Tomas (Montana State University)
Glass, Leon (McGill University)
Heuett, Will (University of Washington)
Iglesias, Pablo (Johns Hopkins University)
Ingalls, Brian (University of Waterloo)
Jaeger, Johannes (Stony Brook University)
Kauffman, Stuart (Santa Fe Institute)
Khammash, Mustafa (UC-Santa Barbara)
Kim, Jongmin (California Institute of Technology)
Kozlov, Konstantin (St. Petersburg State Polytechnical University)
Levchenko, Andre (Johns Hopkins University)
Louis, Matthieu (Rockefeller University)
Maass, Wolfgang (Technische Universität Graz)
Mincheva, Maya (University of Lethbridge)
Narang, Atul (University of Florida)
Othmer, Hans (University of Minnesota)
Peterson , Carsten (Lund University)
Prusinkiewicz, Przemyslaw (University of Calgary)
Seeman, Nadrian (New York University)
Sepulchre , Rodolphe (Université de Liège)
Sontag, Eduardo (Rutgers University)
Stojanovic, Milan (Columbia University)
Surette, Michael (University of Calgary)
Swain, Peter (McGill University)
Van Oudenaarden, Alexander (MIT)
Weiss, Ron (Princeton University)
Winfree, Erik (California Institute of Technology)
Yurke, Bernard (Bell Labs/Lucent)

Combinatorial Hopf Algebras
August 28–September 2, 2004

Organizers:

Frank Sottile (Texas A&M University)
Nantel Bergeron (York University)
Louis Billera (Cornell University)
Stephanie van Willigenburg (University of British Columbia)

Recent foundational work has uncovered new connections between active communities within the diverse subjects of combinatorics, algebra, geometry, and theoretical physics. This has created a new and vibrant subject of Combinatorial Hopf Algebras. A small weekend AMS/CMS meeting in Montréal in May 2002 in this subject was the first time that some of these people had met to exchange ideas. There, a consensus emerged that workshop at which participants could interact over a longer period would be crucial for the further development of this emerging subject. This workshop was a response to that need.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5011/

Participants:

Aguiar, Marcelo (Texas A&M University)
Aval, Jean-Christophe (LABRI, Université de Bordeaux I)
Bayer, Margaret (University of Kansas)
Bergeron, Francois (LACIM, UQAM)
Bergeron, Nantel (York University)
Billera, Louis (Cornell University)
Cartier, Pierre (Institut Mathematique de Jussieu)
Chapoton, Frédéric (Institut Girard Desargues, Lyon 1)
Ebrahimi-Fard, Kurusch (IHES)
Ehrenborg, Richard (University of Kentucky)
Frabetti, Alessandra (Institut Girard Desargues, Lyon 1)
Garsia, Adriano (UCSD)
Gessel, Ira (Brandeis University)
Grossman, Robert (University of Illinois at Chicago)
Guo, Li (Rutgers University, Newark)
Hazewinkel, Michiel (CWI)
Hetyei, Gabor (University of North Carolina at Charlotte)
Hivert, Florent (Charge de recherche CNRS)
Hohlweg, Christophe (The Fields Institute)
Holtkamp, Ralf (Ruhr-Universität Bochum)
Hsiao, Samuel (University of Michigan)
Kapetanovic, Selma (York University)
Lauve, Aaron (Rutgers University)
Loday, Jean-Louis (Institut de Recherche Mathématique Avancée)
Moreira, Walter (Texas A&M University)
Novelli, Jean-Christophe (Marne la valle)
Nyman, Kathryn (Texas A&M University)
Pereira, Mariana (MSRI)
Readdy, Margaret (University of Kentucky)
Reading, Nathan (University of Michigan)
Reiner, Vic (University of Minnesota)
Ronco, Maria (Universidad de Buenos Aires)
Schmitt, William (The George Washington University)
Schocker, Manfred (Oxford University)
Sottile, Frank (Texas A&M University)
Stembridge, John (University of Michigan)
Taskin, Muge (University of Minnesota)
Thomas, Hugh (University of New Brunswick)
Zabrocki, Mike (York University)
van Willigenburg, Stephanie (UBC)

Pluripotential Theory and its Applications
September 4–9, 2004

Organizers:

Len Bos (University of Calgary)
Eric Bedford (Indiana University)
Alex Brudnyi (University of Calgary)
Al Taylor (University of Michigan)

As a relatively new field, the methods and results of Pluripotential Theory are not well known to researchers in other parts of mathematics. In this BIRS workshop, it was our intention to bring together experts in Pluripotential Theory with those who might best benefit from exposure to its methods or have used similar tools in their work. Conversely, pluripotential theorists would benefit immensely through the learning of possible new applications and problems that arise from other fields. It was our hope and expectation that such a workshop will lead to fruitful cooperation across areas. The topics of the workshop were General PSH Theory, PSH in Complex Dynamics, PSH Functions on Varieties, Multivariate Potential Theory and Multivariate Polynomial Inequalities.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5035/

Participants:

Alan, Muhammed Ali (Indiana University)
Baran, M. (Jagiellonian University)
Bedford, Eric (Indiana University)
Blocki, Zbigniew (Jagiellonian University**)**
Bloom, Thomas (University of Toronto)
Bos, Len (University of Calgary)
Branker, Maritza (University of Toronto)
Brudnyi, Alex (University of Calgary)
Cegrell, Urban (Mid Sweden University)
Coman, Dan (Syracuse University)
DeMarco, Laura (University of Chicago)
Diller, Jeffrey (University of Notre Dame)
Gogus, Nihat (Syracuse University)
Guedj, Vincent (Université Paul Sabatier)
Kolodziej, Slawomir (Jagiellonian University)
Larusson, Finnur (University of Western Ontario)
Levenberg, Norm (University of Auckland)
Mau, Sione (University of Auckland)
Meise, R. (Universitat Dusseldorf)
Milman, Pierre (University of Toronto)
Poletsky, Evgeny (Syracuse University)
Ransford, Thomas (Universite Laval)
Rumely, Robert (University of Georgia)
Révész, Sz. (Alfréd Rényi Institute of Mathematics)
Saff, Ed (Vanderbilt University)
Sigurdsson, Ragnar (University of Iceland)
Stawiska, Malgorzata (Purdue University)
Taylor, Al (University of Michigan)
Totik, Vilmos (University of South Florida/University of Szeged)
Vogt, Dietmar (Bergische Universitat Wuppertal)
Wiegerinck, Jan (University of Amsterdam)
Wikstrom, Frank (University of Michigan)
Yomdin, Yosef (The Weizmann Institute of Science)
Zaharyuta, Vyacheslav P. (Sabanci University)

Commutative Algebra: Homological and Birational Theory
September 11–16, 2004

Organizers:

Ragnar-Olaf Buchweitz (University of Toronto)
Paul Roberts (University of Utah)
Bernd Ulrich (Purdue University)

The topics listed below were addressed in this BIRS workshop:

1. Problems in positive and mixed characteristic
   - Positive characteristic and tight closure
   - Mixed characteristic and the homological conjectures
   - Hilbert-Kunz multiplicities
2. Homological methods
   - Commutative Algebra and Exterior Algebra
   - Vanishing results for Ext and Tor functors
3. Integral dependence and integral closures.
   - Multiplier ideals and cores
   - Rees algebras and singularities
   - Multiplicities and computational problems

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5027/

Participants:

Avramov, Luchezar (University of Nebraska at Lincoln)
Bruns, Winfried (University of Osnabrueck)
Buchweitz, Ragnar-Olaf (University of Toronto)
Chardin, Marc (CNRS)
Corso, Alberto (University of Kentucky)
Cutkosky, Steven Dale (University of Missouri-Columbia)
Ein, Lawrence (University of Illinois at Chigago)
Faridi, Sara (LaCIM Universite du Quebec a Montreal)
Flenner, Hubert (University of Bochum)
Goto, Shiro (Meiji University, Tokyo)
Hara, Nobuo (Tohoku University)
Hochster, Mel (University of Michigan)
Huneke, Craig (University of Kansas)
Iyengar, Srikanth (University of Nebraska-Lincoln/ University of Missouri-Columbia)
Jorgensen, David (University of Texas at Arlington)
Katzman, Moty (University of Sheffield)
Leuschke, Graham (University of Toronto)
Lipman, Joseph (Purdue University)
McDermott, Moira (Gustavus Adolphus College, Minnesota)
Miller, Claudia (Syracuse University)
Monsky, Paul (Brandeis University)
Polini, Claudia (University of Notre Dame)
Roberts, Paul (University of Utah)
Sather-Wagstaff, Sean (University of Nebraska-Lincoln)
Sega, Liana (Michigan State University)
Sharp, Rodney (University of Sheffield)
Singh, Anurag (Georgia Tech)
Srinivas, Vasudevan (Tata Institue of Fundamental Research)
Ulrich, Bernd (Purdue University)
Watanabe, Keiichi (Nihon Umiversity, Tokyo)

Quantum Computation and Information Theory
September 18–23, 2004

Organizers:

John Watrous (University of Calgary)
Richard Cleve (Universiy of Calgary)
Umesh Vazirani (UC-Berkeley)

Various sub-fields of quantum information processing have developed, including the sub-fields of quantum information theory and quantum algorithms and complexity. The objective of the workshop was to bring together outstanding researchers from these sub-fields in order to interact with one another, to share problems and recent discoveries, to collaborate on problems these areas have in common, and to explore other connections between these areas. BIRS offers an excellent opportunity to do this.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5041/

Participants:

Aaronson, Scott (UC-Berkeley)
Aharonov , Dorit (Hebrew University)
Ambainis , Andris (University of Waterloo)
Bacon, Dave (Santa Fe Institute)
Cheung, Donny (University of Waterloo)
Childs, Andrew (California Institute of Technology)
Cleve, Richard (University of Calgary)
Fenner, Stephen (University of South Carolina)
Fuchs, Christopher (Bell Labs)
Gavinsky, Dmitry (University of Calgary)
Gerhardt, Heath (University of Calgary)
Gottesman , Daniel (Perimeter Institute)
Hallgren, Sean (NEC Labs)
Hoyer , Peter (University of Calgary)
Kerenidis, Iordanis (UC-Berkeley)
Klauck , Hartmut (University of Frankfurt)
Kobayashi , Hirotada (Japan Science and Technology Agency)
Leung , Debbie (California Institute of Technology)
Moore, Cris (University of New Mexico)
Nayak , Ashwin (University of Waterloo)
Perez , Carlos (University of Waterloo)
Preda, Daniel (UC-Berkeley)
Reichardt, Ben (UC-Berkeley)
Roehrig , Hein (University of Calgary)
Russell, Alex (University of Connecticut)
Sanders , Barry (University of Calgary)
Schulman , Leonard (California Institute of Technology)
Scott, Andrew (University of Calgary)
Selinger, Peter (University of Ottawa)
Sen, Pranab (University of Waterloo)
Shi, Yaoyun (University of Michigan)
Smolin, John (IBM)
Szegedy , Mario (Rutgers)
Toner , Ben (California Institute of Technology)
Vazirani, Umesh (UC-Berkeley)
Watrous, John (University of Calgary)

Interaction of Finite Dimensional Algebras with Other Areas of Mathematics September 25–30, 2004

Organizers:

Vlastimil Dlab (Carleton University)
Claus Ringel (Universitaet Bielefeld)
Leonard Scott (University of Virginia)

The Workshop concentrated on several topics reflecting a close relationship between the theory of finite dimensional associative algebras and other areas of Mathematics. It dealt, in particular, with relations between Lie theory and the representation theory of quivers. Methods concerning quivers and their representations have been used in the past 30 years extensively in order to describe the structure of length categories (Abelian categories where every object has a finite composition series) which arise very frequently not only in algebra, but also in geometry and analysis. They enable a better understanding of the indecomposable objects and allow often a definite presentation of the category by generators and relations. There are several quite surprising relations to Lie theory: first of all, several length categories play a prominent role in Lie theory such as the category *O* of categories of Harish-Chandra modules and they can be investigated successfully using the representation theory of finite dimensional algebras. And second, one may use the representation theory of special finite dimensional algebras in order to construct Lie algebras and quantum groups.

The Workshop also reflected the latest work on quasi-hereditary algebras and their generalizations.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5501/

Participants:

Agoston, István (Eötvös University)
Ariki, Sumusu (Kyoto University)
Avramov, Luchezar L. (University of Nebraska)
Berman, Stephen (University of Saskatchewan)
Brüstle, Thomas (Bishop's University)
Chen , Xueqing (University of Ottawa)
Dlab, Vlastimil (Carleton University)
Du, Jie (University of New South Wales)
Erdmann, Karin (University of Oxford)
Ginzburg, Victor (University of Chicago)
Holtmann, Angela (Universität Bielefeld)
Iyama, Osamu (Kyoto University)
Kessar, Radha (Ohio State University)
Kleshchev, Alexander S. (University of Oregon)
Koenig, Steffen (University of Leicester)
Kumar, Shrawan (UNC-Chapel Hill)
Leclerc, Bernard (Université de Caen)
Lin, Zongzhu (Kansas State University)
Linckelmann, Markus (Ohio State University)
Liu, Shiping (Université de Sherbrooke)
Malkin, Anton (MIT)
Mathas, Andrew (University of Sydney)
Nakano, Daniel K. (University of Georgia)
Neher , Erhard (University of Ottawa)
Parshall, Brian (University of Virginia)
Phillips, Aaron M. (University of Virginia)
Pospichal, Tomas (Carleton University)
Pucinskaite, Daiva (Universität Bielefeld)
Ringel, Claus Michael (Universität Bielefeld)
Rouquier, Raphaël (CNRS-Université Paris 7)
Schiffmann, Olivier (ENS Paris)
Schmidmeier, Markus (Florida Atlantic University)
Schröer, Jan (University of Leeds)
Scott, Leonard L. (University of Virginia)
Stroppel, Catharina (University of Glasgow)
Tanisaki, Toshiyuki (Osaka City University)
Turner, Will (University of Bristol)
Wang, Weiqiang (University of Virginia)
Webb, Peter (University of Minnesota)
Xiao, Jie (Tsinghua University)

Self-Stabilizing Distributed Systems
October 2–7, 2004

Organizers:

Lisa Higham (University of Calgary)
Anish Arora (Ohio State University)
Faith Fich (University of Toronto)
Maurice Herlihy (Brown University)
Ted Herman (University of Iowa)

Fundamental synchronization and coordination primitives lie at the heart of distributed computer systems. These systems rely on algorithms for synchronization and coordination problems such as mutual exclusion, dining philosophers, leader election, token-circulation and identifier assignment to manage the use of resources and to control communication. However, as the number of components in these systems grows the likelihood of some component failure also increases, causing the traditional solutions to these problems to fail. Hence, algorithm designers seek to make systems more reliable by building fault-tolerance into their distributed protocols.

Self-stabilization is a particularly robust and appealing model of fault-tolerance for distributed computation. A distributed system is self-stabilizing if, when started from an arbitrary initial configuration, it is guaranteed to reach a legitimate configuration as execution progresses, and once a legitimate configuration is achieved, all subsequent configurations remain legitimate. Thus a self-stabilizing system will recover from a burst of transient faults (moving the system to some arbitrary configuration) without the need for manual intervention, as long as no further faults occur. The definition of self-stabilizing systems implies that they need not be initialized. This is an additional advantage particularly for systems that are physically widely dispersed. Furthermore, frequently (but not always) the techniques used to make the system converge apply even when the system can change dynamically. In this case systems need not be reset when a processing node or communication channel is added, reconfigured or removed.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5531/

Participants:

Abraham, Uri (Ben-Gurion University of the Negev)
Arora, Anish (Ohio State University)
Bejan, Alina (University of Iowa)
Boulinier, Christian (LaRIA, CNRS)
Brukman, Olga (Ben-Gurion University of the Negev)
Cobb, Jorge (The University of Texas-Dallas)
Dolev, Shlomi (Ben-Gurion University of the Negev)
Fich, Faith Ellen (University of Toronto)
Ghosh, Sukumar (University of Iowa)
Gouda, Mohamed (University of Texas-Austin)
Gradinariu, Maria (IRISA, Rennes)
Herman, Ted (University of Iowa)
Higham, Lisa (University of Calgary)
Huang, Shing-Tsaan (National Central University Taiwan)
Ioannidou, Kleoni (University of Toronto)
Johnen, Colette (Université de Paris Sud)
Kamaluddeen, Nuha (University of Calgary)
Karaata, Mehmet (Kuweit University)
Katayama, Yoshiaki (Nagoya Institute of Technology)
Manne , Fredrik (University of Bergen, Norway)
Masuzawa, Toshimitsu (Osaka University)
Nesterenko, Mikhail (Kent State University)
Schiller, Elad (Ben-Gurion University of the Negev)
Srimani, Pradip (Clemson University)
Tixeuil, Sébastien (Université de Paris Sud)
Yamashita, Masafumi (Kyushu University)
Zaks, Shmuel (The Technion, Haifa Israel)
Zhang, Chen (University of Iowa)
Zhang, Hongwei (The Ohio State University)

Free Probability Theory
October 9–14, 2004

Organizers:

Alexandru Nica (University of Waterloo)
Roland Speicher (Queen's University)
Dan Voiculescu (UC-Berkeley)

Alexandru Nica (University of Waterloo)
Roland Speicher (Queen's University)
Dan Voiculescu (UC-Berkeley)

Free probability theory is a line of research which parallels aspects of classical probability, in a non-commutative context where tensor products are replaced by free products, and independent random variables are replaced by free random variables. It grew out from attempts to solve some longstanding problems about von Neumann algebras of free groups. In the twenty years since its creation, free probability has become a subject in its own right, with connections to several other parts of mathematics: operator algebras, the theory of random matrices, classical probability and the theory of large deviations, algebraic combinatorics. Free probability also has connections with some mathematical models in theoretical physics.

The BIRS workshop on free probability brought together a very strong group of mathematicians representing the current directions of development in the area. This continued a sequence of very successful 5-day workshops organized on these lines, like the ones at the Fields Institute in March 1995, at CIRM Luminy in January 1998, and at MSRI in January 2001. In the report we look in more detail at what are the current directions of development in free probability, with an emphasis on how they were represented in the BIRS workshop.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5028/

Participants:

Anshelevich, Michael (UC-Riverside)
Bauer, Robert (University of Illinois at Urbana)
Belinschi, Serban (Indiana University)
Ben Arous, Gerard (New York University)
Bercovici, Hari (Indiana University)
Bozejko, Marek (University of Wroclaw)
Cabanal-Duvillard, Thierry (Universite Rene Descartes)
Capitaine, Mireille (Universite Paul Sabatier)
Collins, Benoit (University of Kyoto)
Dykema, Ken (Texas A&M University)
Effros, Edward (UCLA)
Ghosh, Shamindra (University of New Hampshire)
Goodman, Frederick (University of Iowa)
Goulden, Ian (University of Waterloo)
Guionnet, Alice (Ecole Normale Superieure de Lyon)
Haagerup, Uffe (University of Southern Denmark)
Hiai, Fumio (Tohoku University)
Hora, Akihito (Okayama University)
Jung, Kenley (UC-Berkeley)
Koestler, Claus (Queen's University)
Lehner, Franz (TU Graz)
Mingo, James (Queen's University)
Neagu, Michael (University of Waterloo)
Nica, Alexandru (University of Waterloo)
Petz, Denes (Budapest University of Technology and Economics)
Pimsner, Michael (University of Pennsylvania)
Radulescu, Florin (The University of Iowa)
Ricard, Eric (Universite de Besancon)
Savu, Ana Maria (Queen's University)
Schultz, Hanne (University of Southern Denmark)
Shlyakhtenko, Dimitri (UCLA)
Sniady , Piotr (University of Wroclaw)
Soshnikov, Alexander (UC-Davis)
Speicher, Roland (Queen's University)
Thorbjornsen, Steen (University of Southern Denmark)
Ueda, Yoshimichi (Kyushu University)
Voiculescu, Dan (UC-Berkeley)

Braid Groups and Applications
October 16–21, 2004

Organizers:

Dale Rolfsen (University of British Columbia)
Joan Birman (Columbia University)
Patrick Dehornoy (University of Caen)
Roger Fenn (University of Sussex)
Vaughan Jones (UC-Berkeley)

The objective of the workshop was to bring together the world's experts on several different aspects and applications of braid theory. The idea was to share problems and ideas, stimulate new research and hopefully make progress in certain open problems. An example of such a question is whether the Jones representations are faithful and the related question of whether the Jones polynomial characterizes triviality of knots. Algorithmic questions in braid theory were explored. They have a new importance, due to the possible applications to cryptography. A number of experts in dynamical aspects of braids were presented. We studied and extended fascinating connections, for example, between the entropy of a dynamical system described by certain braids and the classical Burau representation. Experts on the cohomology (and similar properties) of braid groups were also presented. As a demonstration of the subtlety of the subject, Fred Cohen had shown that a certain combinatorial question regarding pure braids, if completely answered, would tell us all the homotopy groups of spheres, a notoriously difficult problem in algebraic topology. Another goal of the workshop was to understand the connections of braid theory with mathematical physics, e. g. quantum field theory, quantum gravity and statistical mechanics.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5526/

Participants:

Bigelow, Stephen (UC-Santa Barbara)
Birman, Joan (Barnard College, Columbia University)
Brendle, Tara (Cornell University)
Clay, Adam (University of British Columbia)
Cohen, Frederick (University of Rochester)
Crans, Alissa (Loyola Marymount University)
Dehornoy, Patrick (University of Caen)
Digne, François (Université de Picardie Jules-Verne)
Erlijman, Juliana (University of Regina)
Gebhardt, Volker (University of Sydney)
Ghosh, Shamindra (University of New Hampshire)
Godelle, Eddy (Universite de Caen)
Gonzalez-Meneses, Juan (University of Seville)
Hao, Zheng (Peking University)
Hauschild, Holly (University of Iowa)
Kassel, Christian (CNRS et Université Louis Pasteur)
Kawamuro, Keiko (Columbia University)
Kohno, Toshitake (University of Tokyo)
Krammer, Daan (University of Warwick)
Kudryavtseva, Elena (University of Calgary)
Lehrer, Gus (University of Sydney)
Lescop, Christine (Université Joseph Fourier, Grenoble)
Lin, Xiao-Song (UC-Riverside)
Margalit, Dan (University of Utah)
Marin, Ivan (Universite d'Evry)
Masbaum, Gregor (Universite Paris 7)
Menasco, William (University at Buffalo)
Michel, Jean (Universite Paris 7)
Morrison, Scott (UC-Berkeley)
Murakami, Hitoshi (Tokyo Institute of Technology)
Paris, Luis (Université de Bourgogne)
Rolfsen, Dale (University of British Columbia)
Shpilrain, Vladimir (City College of New York)
Watson, Liam (University of British Columbia)
Wenzl, Hans (UC-San Diego)
Xicoténcatl, Miguel (Centro de Investigacion y Estudios Avanzados, Mexico City)
Yurasovskaya, Katya (University of British Columbia)

Mathematical Image Analysis and Processing
October 23–28, 2004

Organizers:

Selim Esedoglu (UCLA)
Sung Ha Kang (University of Kentucky)
Mary Pugh (University of Toronto)
Jackie Shen (University of Minnesota)

Mathematical Image Processing is a rapidly growing field. As such, there are many different approaches for addressing similar questions. The main task of our workshop has been to concentrate on a few mathematically intriguing problems, and to allow researchers to present the state-of-the-art in their approaches to these problems. In this way, the workshop has achieved two goals. First, it has provided a forum where results from different approaches can be systematically compared as well as integrated. Second, by making sure a variety of mathematical areas (from pure theoretical analysis to practical computational techniques) are represented, the workshop will encourage more mathematicians to work on imaging and vision problems.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5512/

Participants:

Allard, William K. (Duke University)
Bertozzi, Andrea (Duke/UCLA)
Boutin, Mireille (Purdue University)
Buades Capo, Toni (Centre de Mathematiques et de Leurs Applications)
Chan, Tony (UCLA)
Esedoglu, Selim (UCLA)
Garcia Almeida, Gerardo E. (Universidad Autónoma de Yucatán)
Greer, John B. (Courant Institute)
Gunturk, Sinan (New York University)
Kang, Sung Ha (University of Kentucky)
Levine, Stacey (Duquesne University)
Little, James (University of British Columbia)
Lucier, Bradley (Purdue University)
Majava, Kirsi (University of Jyvaskyla)
Malgouyres, Francois (IMaitre de conference a l'universite Paris 13)
March, Riccardo (IAC-CNR)
Metaxas, Dimitris (Rutgers)
Nikolova, Mila (CMLA, ENS de Cachan)
Oliensis, John (Stevens Institute of Technology)
Park, Fred (UCLA)
Pugh, Mary (University of Toronto)
Rumpf, Martin (Universität Duisburg)
Santosa, Fadil (University of Minnesota)
Scherzer, Otmar (University of Innsbruck)
Schmidt, Volker (University of Ulm)
Shah, Jayant (Northeastern University)
Shen, Jackie (University of Minnesota)
Siddiqi, Kaleem (McGill)
Spira, Alon (Technion)
Tai, Xue-Cheng (University of Bergen)
Tsai, Richard (University of Texas at Austin)
Vemuri, Baba (University of Florida)
Vese, Luminita (UCLA)
Vixie, Kevin (Los Alamos National Laboratory)
Vogel, Curtis (Montana State University)
Whitaker, Ross (University of Utah)
Wolf, Lior (MIT)
Zhou, Hao Min (Georgia Institute of Technology)

The Structure of Amenable Systems
October 30–November 4, 2004

Organizers:

George Elliott (University of Toronto)
Andrew Dean (Lakehead University)
Thierry Giordano (University of Ottawa)
Guihua Gong (University of Puerto Rico)
Huaxin Lin (University of Oregon)
N. Christopher Phillips (University of Oregon)

The objectives of the workshop were to evaluate the progress so far of work on the classification of amenable C*-algebras---and on the attendant problems of structure and dynamical systems theory---and to judge the most promising avenues of approach for further work on these challenging problems.

The subject matter of the recent BIRS workshop on amenable systems could be roughly divided into four broad categories: classification of amenable C*-algebras and related topics, C*-algebras associated to directed graphs and related objects, commutative dynamical systems and C*-algebras, and non-commutative dynamical systems. The state of research in amenable systems and the results presented at the workshop are discussed below under these headings.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5045/

Participants:

Bates, Teresa (University of Victoria)
Neufang, Matthias (Carleton University)
Blackadar, Bruce (University of Nevada-Reno)
Blanchard, Etienne (Centre National des Recherches Scientifiques, Jussieu, Paris)
Boca, Florin (University of Illinois)
Brenken, Berndt (University of Calgary)
Brown, Nathanial (Pennsylvania State University)
Buck, Julian (University of Northern British Columbia)
Carlsen, Toke (Norwegian University of Science & Technology)
Dadarlat, Marius (Purdue University)
Dean, Andrew (Lakehead University)
Eilers, Soren (University of Copenhagen)
Elliott, George (University of Toronto)
Giordano, Thierry (University of Ottawa)
Gong, Guihua (University of Puerto Rico)
Hirshberg, Ilan (University of Southern Denmark)
Itza-Ortiz, Benjamin (University of Ottawa)
Ivanescu , Cristian (University of Toronto)
Izumi, Masaki (Kyoto University)
Katsura, Takeshi (Hokkaido University)
Kribs, David (Univeristy of Guelph)
Kucerovsky, Dan (University of New Brunswick)
Kumjian, Alex (University of Nevada, Reno)
Li, Liangqing (University of Puerto Rico)
Lin, Huaxin (University of Oregon)
Matui, Hiroki (Chiba University)
Ng, Ping Wong (University of New Brunswick)
Niu, Zhuang (University of Toronto)
Okayasu, Rui (Osaka Kyoiku University)
Osaka, Hiroyuki (Ritsumeikan University, Kyoto)
Ozawa, Narutaka (University of Tokyo)
Pasnicu , Cornel (University of Puerto Rico)
Phillips, N. Christopher (University of Oregon)
Putnam, Ian (University of Victoria)
Robert, Leonel (University of Toronto)
Savu, Ana (Queen's University)
Skau, Christian (University of Trondheim)
Toms, Andrew (University of New Brunswick)
Wassermann, Simon (University of Glasgow)
Winter, Wilhelm (University of Muenster)

Functional Differential Equations
November 6–11, 2004

Organizers:

Jianhong Wu (York University)
Hans-otto Walther (University of Giessen, Germany)
John Mallet-paret (Brown University)

This workshop brought together international leaders and active researchers working in the theory and applications of functional differential equations for communication of new ideas and results, for review and summary of topics of current interest, for discussions of future research directions and for initiation of further collaborations.

The workshop had three (two-hours) featured lectures in each of the following areas: mixed functional differential equations; delay differential systems with state-dependent lags; delayed reaction-diffusion equations with non-local effects.

There were multiple half-hour lectures, in addition to special sessions on specific topics.

Canada, Germany and USA have strong groups of researchers, and have been playing leading role in both theoretical research and applications of functional differential equations. Germany previously hosted such a workshop in Oberwolfach in 1998, IMA organized a special program in 1990, and thus it is natural and desirable that an international workshop in the area be held in Canada, at Banff station. Canada has active researchers from coast to coast (see listed possible participants below), a workshop at Banff would further stimulate the nationwide collaboration.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5026/

Participants:

Braverman, Elena (University of Calgary)
Buono, Pietro-Luciano (Universite de Montreal)
Campbell , Sue Ann (University of Waterloo)
Chen, Yuming (Wilfrid Laurier University)
Chow, Shui-Nee (Georgia Institute of Technology)
Diekmann, Odo (Utrecht University)
Eichmann, Markus (Universitat Giessen)
Erneux, Thomas (Universite Libre de Bruxelles)
Faria, Teresa (Universidade de Lisboa)
Gedeon, Thomas (Montana State University)
Hadeler, Karl-Peter (Universitaet Tuebingen)
Humphries, Tony (McGill University)
Krisztin, Tibor (University of Szeged)
Kyrychko , Yuliya (University of Surrey)
Lani-Wayda, Bernhard (Universitaet Giessen)
Litsyn, Elena (Ben-Gurion University of the Negev)
Mallet-paret, John (Brown University)
Mincheva, Maya (University of Lethbridge)
Ruess, Wolfgang (Universitat Essen)
Sell, George (University of Minnesota)
Sieber, Jan (University of Bristol)
Skubachevskiy, Alexander L. (Moscow State Aviation Institute)
Solonukha, Oles (Central Economical Mathematical Institute of Russian Academy of Science, Moscow)
Verduyn Lunel, Sjoerd (Universiteit Leiden)
Walther, Hans-Otto (University of Giessen, Germany)
Wu, Jianhong (York University)
Zou, Xingfu (University of Western Ontatio)

New Techniques in Lorentz Manifold
November 6–11, 2004

Organizers:

Virginie Charette (University of Manitoba)
Todd Drumm (Swarthmore College)
William Goldman (University of Maryland)

This is an exciting time in the study of Lorentz manifolds. Significant new work is being done in related areas such as flat manifolds and anti-de Sitter space. The workshop gave researchers the opportunity to share techniques and explore ways of incorporating new techniques from different areas into their own. We discussed applications to physics, which playing an increasingly important role in raising new research questions in our field. The workshop should foster new ideas for an old but vital area of mathematics. We focused on the following topics:

1- applications and generalizations of the Margulis invariant; 2- applications of fundamental polyhedra to the classification of flat Lorentz manifolds; 3- new techniques for anti-de Sitter space; 4- interpretations and extensions of Mess's work. 5- applications of new techniques in Lorentz manifolds to Relativity.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5521/

Participants:

Abels, Herbert (Bielefeld University)
Bader, Uri (The Technion)
Barbot, Thierry (UMPA, ENS-Lyon)
Baum, Helga (Humboldt University Berlin)
Beguin, Francois (Laboratoire de mathematique Universite de Paris-Sud)
Brenner, Eliot (Yale University)
Brill, Dieter (University of Maryland)
Charette, Virginie (University of Manitoba)
Choi, Suhyoung (Korea Advanced Institute of Science and Technology)
Drumm, Todd (University of Pennsylvania)
Dumas, David (Rice University)
Frances, Charles (UMPA ENS-Lyon)
Goldman, William (University of Maryland)
Harris, Steven (Saint Louis University)
Labourie, Francois (Universite de Paris-Sud)
Melnick, Karin (University of Chicago)
Morris, Dave (University of Lethbridge)
Mounoud, Pierre (Max Planck Institut fur Mathematik Bonn)
Pratoussevitch, Anna (University of Bonn)
Scannell, Kevin (Saint-Louis University)
Schlenker, Jean-Marc (Lab. Emile Picard, Universite Paul Sabatier)

Explicit Methods in Number Theory
November 13–18, 2004

Organizers:

Peter Borwein (Simon Fraser University)
H.W. Lenstra (UC-Berkeley)
P. Stevenhagen (Universiteit Leiden)
H. Williams (University of Calgary)

Information technology industries have shown serious interest in computational number theory. Many number theoretic constructions find an application in cryptography or coding theory. Furthermore, the computational challenges offered by number theory give an excellent incentive and clear benchmarks for the computing industry to enhance hardware and the constant quest for faster algorithms enhances computational tools in general.

Developments in the participating areas are vast and quick. Many collaborations between physically distant researchers are ongoing and new results in one area often spark off new collaborations with researchers in other areas. This workshop provided an opportunity for the participants to communicate recent developments in the various participating disciplines to experts in the same and in neigbouring areas. The meeting facilitated and promoted new and existing collaborations by giving an opportunity for participants to meet their colleagues in a relatively small, informal and intensive environment.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5502/

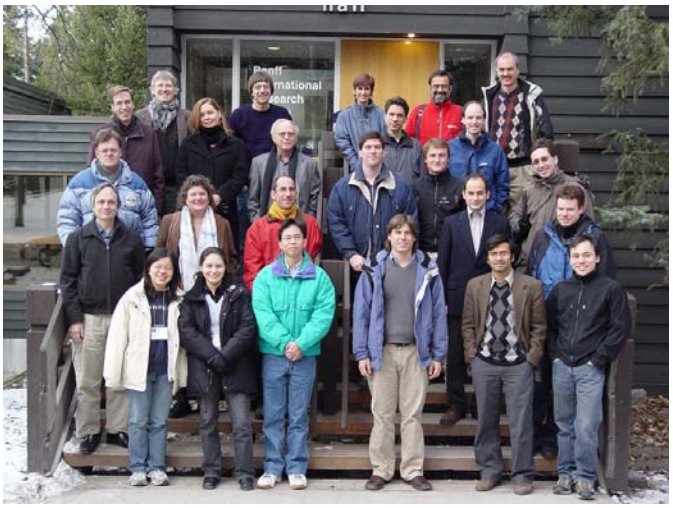
Participants:

Bauer, Mark (University of Calgary)
Bernstein, Daniel (University of Illinois, Chicago)
Bhargava, Manjul (Princeton University)
Borwein, Peter (Simon Fraser University)
Bosma, Wieb (Katholieke Universiteit Nijmegen)
Boyd, David (University of British Columbia)
Bruin, Nils (Simon Fraser University)
Calegari, Frank (Harvard University)
Cohen, Henri (Université Bordeaux)
Cremona, John (University of Nottingham)
Dembele, Lassina (University of Calgary)
Ferguson, Ron (Simon Fraser University)
Girard, Martine (The University of Sydney)
Gunnells, Paul (University of Massachusetts)
Hare, Kevin (University of Waterloo)
Hess, Florian (Technische Universität Berlin)
Klüners , Jürgen (Universität Kassel)
Kohel, David (University of Sydney)
Krutelevich, Sergei (University of Ottawa)
Lauter, Kristin (Microsoft Research)
Lenstra, H.W. (Universiteit Leiden)
Mercer, Idris (Simon Fraser University)
Mossinghoff, Michael (Davidson College)
Mueller, Siguna (University of Calgary)
Mukunda, Keshav (Simon Fraser University)
O'Neil, Catherine (MIT)
Pinch, Richard (HMG, Cheltenham)
Schaefer, Ed (Santa Clara University)
Scheidler, Renate (University of Calgary)
Schoof, Rene (University of Rome II)
Stein, William (Harvard University)
Stevenhagen, Peter (Universiteit Leiden)
Stoll, Michael (International University Bremen)
Teske, Edlyn (University of Waterloo)
Watkins, Mark (Institut Henri Poincare)
Wetherell, Joseph L. (CCR La Jolla)
Wiese, Gabor (Universiteit Leiden)
Williams, Hugh (University of Calgary)
de Smit, Bart (Universiteit Leiden)
van Luijk, Ronald (UC-Berkeley)

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

Organizers:

Michael Bennett (University of British Columbia)
Greg Martin (University of British Columbia)
John Friedlander (University of Toronto)
Andrew Granville (Universite de Montreal)
Cameron Stewart (University of Waterloo)
Trevor Wooley (University of Michigan)



This workshop gathered together researchers with expertise in both Diophantine approximation and analytic number theory in an environment that fosters the presentation and sharing of the latest ideas in both fields. Number theory is unique among the major fields of mathematics in that it combines problems and questions of incredible simplicity and accessibility with truly deep and technical tools and methods for addressing these questions. A reduction of a problem in one area of number theory (and indeed in many other mathematical fields as well) often involves a very simply stated question in the other area, which can seem difficult to resolve if one is not well-versed in the techniques of the second area. Often, contact and communication between Diophantine approximation researchers and analytic number theorists is the greatest obstacle to overcome on the way to significant advances on both sides. This accessibility that number theory possesses is another reason that involving young researchers in the workshop is so profitable.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5507/

Participants:

Bauer, Mark (University of Calgary)
Bennett, Michael (University of British Columbia)
Blomer, Valentin (University of Toronto)
Bugeaud, Yann (Universite Louis Pasteur)
Choi, Stephen (Simon Fraser University)
Cohen, Paula (Texas A&M University)
Corvaja, Pietro (University of Udine)
David, Chantal (Concordia University)
Ellenberg, Jordan (Princeton University)
Evertse, Jan-Hendrik (University of Leiden)
Ferguson, Ron (Simon Fraser University)
Filaseta, Michael (University of South Carolina)
Ford, Kevin (University of Illinois)
Foster, Chris (University of Calgary)
Helfgott, Harald (Yale University)
Kadiri, Habiba (Universite de Montreal)
Liu, Yu-Ru (University of Waterloo)
Lucier, Jason (University of Waterloo)
Martin, Greg (University of British Columbia)
McKinnon, David (University of Waterloo)
Mihailescu, Preda (Universität Paderborn)
Mulholland, Jamie (University of British Columbia)
Ng, Nathan (Universite de Montreal)
Roy, Damien (University of Ottawa)
Soundararajan, Kannan (University of Michigan)
Stewart, Cameron (University of Waterloo)
Thunder, Jeff (Northern Illinois University)
Venkatesh, Akshay (MIT)
Waldschmidt, Michel (Universite Pierre et Marie Curie, Paris VI)
Walling , Lynne (University of Colorado-Boulder)
Walsh, Gary (University of Ottawa)
Wooley, Trevor (University of Michigan)
van der Poorten, Alf (Macquarie University)

Mathematical Models for Biological Invasions
November 27–December 2, 2004

Organizers:

Mark Lewis (University Alberta)
Mark Kot (University of Washington)
Pauline van den Driessche (University of Victoria)

The spread of introduced species is one of the most important applied problems in ecology. From a scientific perspective, the field of invasion biology has matured greatly in the last few years as ecologists have tried to come to grips with the risks, damages, and spatial spread of introduced species. At the same time, quantitative biologists and mathematical modelers have become increasingly aware of the limitations inherent in the early quantitative models. It is possible to include the missing ingredients in systems of coupled nonlinear reaction-diffusion equations, systems of integral-based equations, such as integrodifference (discrete-time, continuous space) equations, or as stochastic, interacting particle models. Some progress has been made on such analysis of these systems, although, to date, results have not always been communicated widely.

This meeting brought together a group of expert mathematicians and quantitative biologists with the following goals: 1. communicate recent advances in the mathematical analysis of invasion problems, and advances in the application of these results to real ecosystems; 2. propose future directions for research in the mathematics of biological invasions with a view to developing areas where the interaction between models and science is strong.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5539/

Participants:

Atapour, Mahshid (University of Saskatchewan)
Bampfylde, Caroline (University of Alberta)
Bullock, James (NERC Centre for Ecology and Hydrology, Winfrith)
Cantrell, Steve (University of Miami)
Caswell, Hal (Woods Hole Oceanographic Institution)
Clark, Jim (Duke University)
Cosner, Chris (University of Miami)
Desjardins, Sylvie (Okanagan University College)
Drury, Kevin (University of Notre Dame)
Edwards, Andrew (Dalhousie University)
Fagan, Bill (University of Maryland)
Fife, Paul (University of Utah)
Hadeler, Karl (Universität Tübingen)
He, Fangliang (University of Alberta)
Hosono, Yuzo (Kyoto Sangyo University)
Hu, Xinsheng (University of Alberta)
Hunter, Christine (Woods Hole Oceanographic Institution)
Jerde, Chris (University of Alberta)
Kot, Mark (University of Washington)
Lambert, Amaury (Ecole Normale Supérieure)
Lewis, Mark (University of Alberta)
Li, Bingtuan (University of Louisville)
Liebhold, Andrew (USDA Forest Service)
Lui, Roger (Worcester Polytechnic Institute)
Lutscher, Frithjof (University of Alberta)
Medlock, Jan (Yale University)
Neubert, Mike (Woods Hole Oceanographic Institute)
Owen, Markus (University of Nottingham)
Parker, Ingrid (UC-Santa Cruz)
Potapov, Alex (University of Alberta)
Powell, James (Utah State University)
Reluga, Timothy (Yale University)
Robbins, Tom (University of Utah)
Shea, Katriona (Pennsylvania State University)
Thieme, Horst (Arizona State University)
Tyson, Rebecca (Okanagan University College)
Watmough, James (University of New Brunswick)
Weinberger, Hans (University of Minnesota)
Zhao, Xiao-Qiang (Memorial University of Newfoundland)
Zou, Xingfu (University of Western Ontario)
de-Camino-Beck, Tomas (University of Alberta)
van den Driessche, Pauline (University of Victoria)

Generalizations of de Generalizations of de Bruijn Cycles and Gray Codes
December 4–9, 2004

Organizers:

Brett Stevens (Carleton University)
Joe Buhler (Reed College)
Persi Diaconis (Stanford University)
Fan Chung (UC-San Diego)
Ronald Graham (UC-San Diego)
Frank Ruskey (University of Victoria)

To our knowledge, no meeting has yet focused on the theory, constructions, and generalizations of de Bruijn cycles, despite the fact that many people in diverse areas have been working on aspects of universal cycles of one kind or another.

Several recent strands of activity suggest that the time is ripe for bringing workers together in this area. The primary goals of this workshop would be to give an overview of the various known results on de Bruijn sequences and universal cycles in general, and to exploit the diversity of the attendees in order to stimulate new work. The workshop focused on several questions in which progress seems imminent or likely, and we will now enumerate some of these areas.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5039/

Participants:

Buhler, Joe (Reed College)
Casteels, Karel (University of Waterloo)
Chung Graham, Fan (UC-San Diego)
Cooper, Joshua (New York University)
Dewar, Megan (Carleton University)
Diaconis, Persi (Stanford University)
Fredricksen, Harold (West Point Naval School)
Godbole, Anant (East Tennessee State University)
Graham, Ronald (UC-San Diego)
Hurlbert, Glenn (Arizona State University)
Jackson, Brad (San Jose State University)
Johnson, Robert (Queen Mary University of London)
McKay, Brendan (Australian National University)
Moreno, Eduardo (University de Chile)
O'Bryant, Kevin (University of California)
Roby, Tom (California State University)
Ruskey, Frank (University of Victoria)
Savage, Carla (North Carolina State University)
Stevens, Brett (Carleton University)
West, Julian (Malaspina University-College)
Weston, Mark (University of Victoria)
Williams, Aaron (University of Victoria)

Numeracy and Beyond
December 4–9, 2004

Organizers:

Klaus Hoechsmann (PIMS)
Tony Gardiner (University of Birmingham)
Bernard Madison (University of Arkansas)
Yoram Sagher (Florida Atlantic University)
Günter Törner (University of Duisburg)

This was the conclusion of a two part workshop called Numeracy and Beyond begun at PIMS, Vancouver, July 8—11, 2003, and intended not as a gathering of experts offering advice, but one of people with insight and experience in mathematics and its promulgation, soberly examining the question of what level of numeracy might be required of average citizens in the future, and how it would relate to the needs of engineers or scientists.

The first priority was to identify key principles, which are simple, widely acceptable, and fundamental, which could guide teaching and learning, and be largely independent of particular contexts. After detailed presentations and discussions, touching on the various subjects involved, such as the decimal system, fractions, statistics, measurement, graphics, geometry, etc., the following four points had emerged.

1. Cultivation of numeracy, though built on K-12 education, should continue through the college curriculum in close cooperation with other disciplines.

2. Elementary mathematics, being the foundation of numeracy and impinging on many other fields, should be taught with great care and learnt thoroughly.

3. Curricula should sufficiently lean to allow deeper treatment of core topics; their goals should be stated in concise documents with minimal adumbration.

4. Teachers should train to be “at home” in basic mathematics, if necessary at the expense of exploring educational theory not closely related to teaching.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5044/

Participants:

Askey, Richard (University of Wisconsin)
Delord, Michel (Societe Mathematique de France)
Ekeland, Ivar (PIMS)
Friesen, Sharon (University of Calgary)
Gardiner, Tony (University of Birmingham)
Gaudry, Garth (University of New South Wales)
Goldman, Madge (Gabriella and Paul Rosenbaum Foundation)
Goris, Tom (Freudenthal Institute)
Hoechsmann, Klaus (PIMS)
Hoogland, Kees (APS-National Center for School Improvement)
Hughes Hallett, Deborah (University of Arizona)
Katich, Ilija (Matematichka Gimnazija Sarajevo)
Keshet, Joshua (MathCounts Canada)
Krueger, Katja (University of Frankfurt)
Lott, Johnny (University of Montana)
Madison, Bernard (University of Arkansas)
Mighton, John (Fields Institute)
Nicol, Cynthia (University of British Columbia)
Packer, Arnold (Johns Hopkins University)
Sagher, Yoram (Florida Atlantic University)
Scheaffer, Richard (University of Florida)
Sirotich, Natasha (Collingwood School)
Toerner, Guenter (University of Duisburg-Essen)
Wu, Hung-Hsi (University of California)

Workshop on Resolution of Singularities, Factorization of Brational Mappings, and Toroidal Geometry
December 11–16, 2004

Organizers:

Kenji Matsuki (Purdue University)
Dan Abramovic (Boston University)
Edward Bierstone (University of Toronto)
Steven Dale Cutkosky (University of Missouri)
Pierre Milman (University of Toronto)
Jaroslaw Wlodarczyk (Purdue University)

Toric geometry is the study of the rich and beautiful geometry of toric varieties, a fairly limited class of rational varieties. Yet this subject interacts in surprising ways with the birational geometry of arbitrary varieties. A major focus of the workshop was this point of friction between the subjects.

The Workshop concentrated on research and goals in three main subjects — resolution of singularities, factorization of birational mappings, and toroidalization of morphisms — as well as on interactions among them.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w5510/

Participants:

Abramovich, Dan (Boston University)
Ban , Chunsheng (Ohio State University)
Berchtold, Florian (Universitat Konstanz)
Bierstone, Edward (University of Toronto)
Casagrande, Cinzia (Universita di Pisa)
Cossart, Vincent (Universite Versailles Saint-Quentin)
Cutkosky, Steven Dale (University of Missouri)
Eckl, Thomas (University of Cologne)
El-Hitti, Samar (University of Missouri)
Fruehbis-Krueger, Anne (Universitat Kaiserslautern)
Ghezzi, Laura (University of Missouri)
Hanumanthu, Krishna (University of Missouri)
Ishii, Shihoko (Tokyo Institute of Technology)
Jahnke, Priska (Universitet Bayreuth)
Karu, Kalle (University of British Columbia)
Kawamata, Yujiro (The University of Tokyo)
Kawanoue, Hiraku (Research Institute for Mathematical Scienses)
Kuhlmann, Franz-Viktor (University of Saskatchewan)
Luo, Tie (National Science Foundation)
Matsuki, Kenji (Purdue University)
McEwan , Lee (Ohio State University)
Milman, Pierre (University of Toronto)
Piltant, Olivier (Centre National de la Recherche Scientifique, University Versailles)
Rojas, J. Maurice (Texas A&M University)
Spivakovsky, Mark (Universite Paul Sabatier)
Teissier, Bernard (Centre National de la Recherche Scientifique)
Wlodarczyk, Jaroslaw (Purdue University)

Banff International Research Station

2004

2-day Workshops

Human Infant Speech Perception and Language Acquisition
March 18–20, 2004

Organizers:

Gary Marcus (New York University)
Jacques Mehler (University of Trieste)
Helen Neville (University of Oregon)
Nuria Sebastian-Galles (Universitat de Barcelona)
Janet Werker (University of British Columbia)

In this three-day meeting we explored in depth what types of statistical regularities infants can learn, and whether or not statistical learning suffices to propel an infant into language acquisition proper. Our core group represented a set of psychologists, psycholinguists, linguists, and neuroscientists who have all made fundamental contributions to the current debate contrasting rule vs. statistical learning. We brought together others in our fields, as well as mathematicians and computer scientists to critically discuss the notion of statistical vs. rule learning as it relates to language acquisition, and to compare the power of models that implement rules by symbol manipulation vs. those which rest on statistical regularities. The participation of mathematicians and computer scientists was essential at this juncture for clarifying and sharpening our understanding of these constructs and thereby productively moving the debate forward. We envisioned the meeting being a two-day intensive workshop where new data on rule and statistical learning were presented, and targeted discussions of these data were convened, followed by a more focussed third day during which the issues raised in the two previous days were reviewed, critiqued, and synthesized.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2552/

Participants:

Aslin, Richard (University of Rochester)
Bird, Sonya (University of British Columbia)
Bonatti, Luca (SISSA/ISAS)
Byers-Heinlein, Krista (McGill University)
Dietrich, Christiane (University of British Columbia)
Fais, Laurel (University of British Columbia)
Fels, Sidney (University of British Columbia)
Fennell, Chris (University of British Columbia)
Kemp, Nenagh (University of British Columbia)
Marcus, Gary (New York University)
Maye, Jessica (Northwestern University)
Mehler, Jacques (University of Trieste)
Narayan, Chandan R. (University of Michigan)
Pakulak, Eric (University of Oregon)
Pulleyblank, Douglas (University of British Columbia)
Sabourin, Laura (University of British Columbia)
Sanders, Lisa (University of Oregon)
Sebastian-Galles, Nuria (Parc Cientific- Hospital Sant Joan de Deu)
Storjohann, Rasmus (Simon Fraser University)
Toro, Juan Manuel (Parc Cientific- Hospital Sant Joan de Deu)
Vouloumanos, Athena (University of British Columbia)
Weikum, Whitney (University of British Columbia)
Werker, Janet (University of British Columbia)
Xu, Fei (University of British Columbia)
Yamada, Yoshiko (University of Oregon)
Yeung, H. Henny (University of Maryland)
Yoshida, Katherine (University of British Columbia)

2-day Retreat on Mathematical Ecology and Evolution
March 25–27, 2004

Organizers:

Michael Doebeli (University of British Columbia)
Thomas Hillen (University of Alberta)
Mark Kot (University of Washington)
Mark Lewis (University of Alberta)
Ed McCauley (University of Calgary)

The aim of the 2-day BIRS retreat was to bring together faculty, post doctoral fellows (PDF) and graduate students from several groups that are involved in the *PIMS Collaborative Research Group in Mathematical Ecology and Evolution*. The six organizers nominated one PDF and four students from their corresponding

research groups to participate in this retreat. The format of the workshop was chosen primarily to initiate discussion, promote exchange of ideas, and encourage collaborations. Each student and some of the PDFs were asked to bring a new and open research problem and present it to a working group of about 8 participants to discuss and work on each problem for about 2 hours. The faculty members of each discussion group guided the discussions so as to encourage students to participate and express their ideas. Although complete solutions of the problems were not expected, progress on the problems was made, while introducing the students to new mathematical approaches to problem solving and science.

The format of the workshop was based on the very successful Woods Hole Oceanographic Institute (WHOI) Nantucket Annual Retreat in Mathematical Ecology, run by WHOI scientists Hal Caswell and Mike Neubert.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2540/

Participants:

Bailey, Susan (University of Calgary)
Blachford, Alistair (University of British Columbia)
Cobbold, Christina (University of Glasgow)
Crumrine, Priscilla (University of Calgary)
Davis, Brad (University of British Columbia)
Dawson, Andria (University of Alberta)
Doebeli, Michael (University of British Columbia)
Dore, Rebecca (University of Washington)
Eftimie, Raluca (University of Alberta)
Flanagan, Kyla (University of Calgary)
Hillen, Thomas (University of Alberta)
Jerde, Chris (University of Alberta)
Kot, Mark (University of Washington)
Krkosek, Martin (University of Alberta)
Lee, Jung Min (University of Alberta)
Lewis, Mark (University of Alberta)
Liu, Wenxiang (University of Alberta)
Lutscher, Frithjof (University of Alberta)
McCauley, Ed (University of Calgary)
Medlock, Jan (University of Washington)
Merchant, Sandra (University of British Columbia)
Nelson, Bill (University of Calgary)
Noonburg, Erik (University of Alberta)
Pineda, Mario (University of British Columbia)
Reluga, Tim (University of Washington)
Renclawowicz, Joanna (University of Alberta)
Richards, Shane (University of Calgary)
Simpson, Karilynn (University of Calgary)
Toth, Damon (University of Washington)
Tyerman, Jabus (University of British Columbia)
Walton, David Brian (University of Washington)
Wang, Qian (University of Alberta)
Wonham, Marjoree (University of Alberta)
de-Camino-Beck, Tomas (University of Alberta)

PIMS PDF meeting
April 15–17, 2004

Organizer:

Manfred Trummer (PIMS, UBC & SFU)

This workshop hosted the Annual PIMS Meeting for its postdoctoral fellows. Fourteen PIMS postdoctoral fellows from a huge variety of mathemtical sciences research areas and the PIMS Director, Ivar Ekeland, and Deputy Director, Manfred Trummer, met and all talked about their research areas (a list of abstracts is enclosed).

The purpose of the meeting is to allow participants to see what sort of research problems their peers are workiong on, and to allow participants to make connections if they have common research interests.

The talks were mostly of an introductory nature, but many generated extremely lively discussions. Participants enjoyed the informal discussions, many of them science and research related, many other concerned with all aspects of academic life, including job search strategies, writing of grant applications, and setting up of successful research programmes.

The meeting proved extremely useful to the PIMS postdocs, and BIRS proved to be an ideal setting for this conference.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2542/

Participants:

Boulton, Lyonell (PIMS, UC)
Brecher, Dominic (PIMS, UBC)
Ekeland, Ivar (PIMS, UBC)
Hook, Andrea (PIMS, UBC)
Jung, Jae-Hun (PIMS, UBC)
Kang, Kyungkeun (PIMS, UBC)
Luke, Russell (PIMS, SFU)
Lutscher, Frithjof (PIMS, UA)
Manuch, Jan (PIMS, SFU)
Rangipour, Bahram (PIMS, UVic)
Rolland-Lagan, Anne-Gaelle (PIMS, UC)
Shapiro, Jacob (PIMS, UBC)
Tran, Chuong (PIMS, UA)
Trummer, Manfred (PIMS, UBC & SFU)
Vardarajan, Suneeta (PIMS, UA)
Xu, Jian-Jun (PIMS, SFU)
Zhang, Jianying (PIMS, UBC)

Mathfair Workshop
April 22–24, 2004

Organizers:

Ted Lewis (University of Alberta)
Andy Liu (University of Alberta)
Tom Holloway (University of Alberta)

The BIRS Math Fair workshop was the second year at BIRS and it was unusual for BIRS in that its focus was education rather than research. The participants were teachers from elemetary schools, junior high schools, colleges and universities and also people from other institutions and organizations that have a deep interest in Mathematics Education. The purpose of the workshop was to help teachers learn how to run a successful math fair, to exchange information about math fairs, and to put the members of this diverse group in contact with ech other. A math fair booklet along with a good collection of new puzzles was provided to each participant. Participating teachers were committed to organize math fairs at their own schools after this workshop.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2600/

Participants:

Borges-Couture, Paula (Good Shepherd School)
Drent, Jason (Sundre High School)
Dumanski, Micheal (St. Gerard School)
Friesen, Sharon (GENA)
Gibbs, Sandy (Newton School)
Gibson, Brad (Lorelei School)
Hamly, Roxanne (Newton School)
Hines, Amanda (Sundre High School)
Hohn, Tiina (Grant MacEwan College)
Holloway, Tom (University of Alberta)
Korf, Lisa (University of Washington)
Kowalchuk, Auriana (ESPB)
Kozak, Carla (EPSB)
Lagu, Indy (Mt. Royal College)
Levesque, Josée (Kenilworth Jr. High School)
Lewis, Ted (University of Alberta)
Liu, Andy (University of Alberta)
Lore, Pat (Dovercourt Elementary School)
Lovallo, Patti (Killarney Jr. High School)
Mackie, Jodi (Bisset Elementary School)
Mandin-Kelly, Yvette (Dovercourt Elementary School)
Mayhew, Dennis (Lansdowne Elementary School)
Mertens, Chris (Sundre High School)
Mitchell, Shirley (PIMS)
Muchena, Sherrill (Malcolm Tweddle Elementary School)
Ostopowich , Brad (St. Mary School)
Poulin, Tracy (Lorelei School)
Prefontaine, Suzanne (Holyrood Elementary School)
Price, Tara (Kenilworth Jr. High School)
Reichert, Valarie (Leschi Elementary School, Seattle)
Slen, Gail (John Ware Elementary School)
Steinhauer, Todd (T.D. Baker Junior High School)
Sun, Wen-Hsien (Chiu Chang Publisher)
Thompson, Tanya (Pretty River Academy)
Vaderlind, Paul (Stockholm University)
Warfield, Ginger (University of Washington)
Whillans, Sharon (Malcom Tweddle School)
Whiting, Dolores (EPSB)

Directions in Combinatorial Matrix Theory
May 6–8, 2004

Organizers:

Shaun Fallat (University of Regina)
Hadi Kharaghani (University of Lethbridge)
Steve Kirkland (University of Regina)
Bryan Shader (University of Wyoming)
Michael Tsatsomeros (Washington State University)
Pauline van den Driessche (University of Victoria)

The Directions in Combinatorial Matrix Theory workshop was held at BIRS May 7{8, 2004, and attracted 29 researchers (10 from Canada, 15 from the U.S. and 4 from abroad) and 7 post-doctoral or graduate students. Talks discussed current developments and open problems in the following emerging themes in Combinatorial Matrix Theory: Spectral properties of families of matrices associated with graphs; Matrix theory and graph theory in the service of Euclidean geometry; Algebraic tools for combinatorial problems; and Spectral properties of classes of matrices.

The workshop provided researchers working in combinatorial matrix theory an opportunity to present accounts of their current research, to identify challenges for the discipline to undertake, and to suggest new approaches to explore; it served to establish connections between both individual researchers and between research areas, and so promoted collaboration and new research.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2525/

Participants:

Akelbek , Mahmoud (University of Regina)
Anstee, Richard (University of British Columbia)
Barioli, Fransesco (University of Regina)
Barrett, Wayne (Brigham Young University)
Behbahani, Majid (University of Lethbridge)
Berman, Abraham (Technio–Israel Institute of Technology)
Britz, Thomas (University of Victoria)
Brualdi, Richard (University of Wisconsin-Madison)
Craigen, Robert (University of Manitoba)
Doob, Michael (University of Manitoba)
Fallat, Shaun (University of Regina)
Fiedler, Miroslav (Academy of Sciences of the Czech Republic)
Gibson, Peter (University of Alabama in Huntsville)
Grone, Robert (San Diego State University)
Hershkowitz, Daniel (Technion–Israel Institute of Technology)
Hogben, Leslie (Iowa State University)
Ionin, Yury (Central Michigan University)
Johnson , Charles (College of William and Mary)
Kharaghani, Hadi (University of Lethbridge)
Kim, In-Jae (University of Wyoming)
Kirkland, Steve (University of Regina)
Lancaster, Peter (University of Calgary)
Le, Hien (Washington State University)
Li, Chi-Kwong (College of William and Mary)
Li, Zhongshan (Georgia State University)
Liu, XiaoPing (University of Regina)
Loewy, Raphael (Technion–Israel Institute of Technology)
McDonald, Judith (Washington State University)
Olesky, Dale (University of Victoria)
Pothen, Alex (Old Dominion University)
Schneider, Hans (University of Wisconsin-Madison)
Shader, Bryan (University of Wyoming)
So, Wasin (San Jose State University)
Stuart, Jeff (Pacific Lutheran University)
Tsatsomeros, Michael (Washington State University)
Vander Meulen, Kevin (Redeemer University College)
Varaneckas, Rokas (Washington State University)

Decentralized Discrete Event Systems: Structure, Communication and Control
May 13–15, 2004

Organizers:

Peter Caines (McGill University)
Stephane Lafortune (University of Michigan)
Laurie Ricker (Mount Allison University)
Karen Rudie (Queen's University)
John Thistle (Univeristy of Waterloo)

The workshop themes of structure, communication and control in decentralized discrete event systems were addressed through examinations of modular and hierarchical architectures, languagebased theories of distributed control synthesis, and logics for specication, synthesis and verication of control and communication structures. Potential applications were presented in the elds of distributed control of air and watercraft, distributed robotic self-assembly and power system fault detection. Throughout the two-day meeting the sessions were notable for the informal and lively discussions that accompanied essentially all of the talks.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2040/

Participants:

Lafortune, Stephane (University of Michigan)
Ricker, Laurie (Mount Allison University)
Rudie, Karen (Queen's University)
Boel, Rene (University of Ghent)
Caines, Peter (McGill University)
Feng, Lei (University of Toronto)
Giua, Alessandro (Università di Cagliari)
Gohari, Peyman (Concordia University)
Holloway, Larry (University of Kentucky)
Hubbard, Paul (Defence R&D Canada)
Klavins, Eric (University of Washington, Seattle)
Millan, Jim (NRC)
O'Young, Siu (Memorial University of Newfoundland)
Pappas, George (University of Pennsylvania)
Pinchinat, Sophie (IRISA)
Raisch, Joerg (Universität Magdeburg)
Rohloff, Kurt (University of Michigan)
Romanovski, Iakov (Queen's University)
Srinivasan, Rama (UIUBC)
Thistle, John (University of Waterloo)

Adaptive Wavelet and Multiscale Methods for Partial Differential Equations
June 3–5, 2004

Organizers:

Tony Ware (Univerity of Calgary)
Manfred Trummer (Simon Fraser University)
Bin Han (University of Alberta)
Michael Lamouroux (University of Calgary)
Elena Braverman (University of Calgary)

The development of adaptive wavelet methods for partial differential equations had matured significantly in recent years to the point where it was attracting an increasing amount of attention from engineers and from mathematicians. The purpose of this workshop was to bring together mathematicians, engineers, geophysicists and others and provide an opportunity for the participants to get up to date with recent developments in the theory and practice of adaptive wavelet methods, and together to explore potential applications of these new techniques.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2055/

Participants:

Alam, Jarul (McMaster University)
Braverman, Elena (University of Calgary)
Chen, Wen (University of Alberta)
Ditzian, Zeev (University of Alberta)
Gibson, Peter (University of Calgary)
Han, Bin (University of Alberta)
Israeli, Moshe (Technion–Israel Institute of Technology)
Kwon, Soon-Geol (University of Alberta)
Lamouroux, Michael (University of Calgary)
Li, Hua (University of Calgary)
Liao, Junlin Robert (University of Alberta)
Liu, Songtao (University of Alberta)
Oswald, Peter (Massachusetts Institute of Technology)
Park, Sang Soo (University of Alberta)
Pratt, Aaron (University of Calgary)
Vasudevan, Kris (University of Calgary)
Wang, Mengzhe (University of Alberta)
Ware, Tony (University of Calgary)
Zizler, Peter (Mount Royal College)

The Design and Analysis of Computer Experiments for Complex Systems
July 15–17, 2004

Organizers:

Derek Bingham (Canada Research Chair in Industrial Statistics)
Randy Sitter (Simon Fraser University)

The design and analysis of computer experiments had become increasingly important to scientists and engineers. Researchers world-wide have recognized this as an important emerging area of research. This 2-day workshop at BIRS aimed at addressing the aforementioned topics.

The workshop had support, in part, from the National Programme on Complex Data Strucutres (NPCDS) and had a secondary goal of identifying participants who will help form an international network of researchers in this area. We felt that the BIRS programme would be crucial at meeting the scientific goals of the programme, but also the long-run leadership of Canadian researchers in this emerging area.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2056/

Participants:

Banks, Tom (North Carolina State University)
Bayarri, Susie (University of Valencia)
Berger, Jim (Duke University)
Bingham, Derek (Canada Research Chair in Industrial Statistics)
Booker, Andrew (Boeing)
Brewster, John (University of Manitoba)
Cafeo, John (NISS/GM)
Chipman, Hugh (University of Waterloo)
Gonzalo, Garcia-Donato (Statistical and Applied Mathematical Sciences Institute)
Hengartner, Nick (Los Alamos National Laboratory)
Higdon, Dave (Los Alamos National Laboratory)
Karuri, Stella (University of Waterloo)
Lemieux, Christianne (University of Calgary)
Lin, Chunfang (Simon Fraser University)
Linkletter, Crystal (Simon Fraser University)
Loeppky, Jason (Simon Fraser University)
Lu, Wilson (Simon Fraser University)
Mcleod, Robert (University of Manitoba)
Mease, David (University of Pennsylvania)
Meckesheimer, Martin (Boeing)
Michailidis, George (University of Michigan)
Nakhleh, Charlie (Los Alamos National Labs)
Notz, Bill (Ohio State University)
Palomo, Jesus (Statistical and Applied Mathematical Sciences Institute)
Paulo, Rui (NISS/SAMSI)
Pepin, Jason (Los Alamos National Labs)
Ranjam, Pritam (Simon Fraser University)
Reese, Shane (Brigham Young University)
Rillett, Larry (University of Nebraska)
Sacks, Jerry (NISS)
Santner, Tom (Ohio State University)
Sitter, Randy (Simon Fraser University)
Spiegelman, Cliff (Texas A&M)
Stafford, Jamie (University of Toronto)
Steinberg, David (Tel Aviv University)
Sudijianto, Agus (Bank of America)
Welch, Will (University of British Columbia)
Xu, Jiaying (University of Guelph)
Ye, Kenny (SUNY–Stoneybrook)

Combinatorial and Algorithmic Aspects of Networking and the Internet
August 5–7, 2004

Organizers:

Rajeev Motwani (Stanford University)
Andrei Broder (IBM T.J. Watson)
Srinivasan Keshav (University of Waterloo)

The workshop, Combinatorial and Algorithmic Aspects of Networking and the Internet (CAAN04), was dedicated to exploring the combinatorics and algorithmics of networking. This interdisciplinary field is a rapidly expanding one, primarily due to the influence of the Internet. The Internet is a global network of 700 million users. An additional 300,000 users are added each day. The Internet itself is in constant flux, with connections and content being added and deleted continuously. How does one study, predict, or even model such an entity? This is the challenge addressed by research in large-scale networks. The unique nature of these networks calls for a variety of techniques from a variety of disciplines. The primary goal of this workshop was to bring together this expertise and provide a snapshot of the cutting edge research in this field.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2059/

Participants:

Barrat, Alain (Universite de Paris-Sud)
Bauer, Claus (Dolby Laboratories)
Bonato, Anthony (Wilfrid Laurier University)
Broder, Andrei (IBM)
Bronnimann, Herve (Polytechnic University)
Datta , Suprakash (York University)
Demaine, Erik (MIT)
Demaine, Martin (MIT)
Dorri, Reza (University of Waterloo)
Goel, Ashish (Stanford University)
Grégoire, Jean-Charles (INRS)
Hall, Alexander (ETH Zurich)
Hamel, Angele (Wilfrid Laurier University)
Johnson, Matthew (London School of Economics)
Karakostas, George (McMaster University)
Latapy, Matthieu (LIAFA - Universite Paris 7)
Levy, Eythan (Free University of Brussels)
Lopez-Ortiz, Alejandro (University of Waterloo)
Magnien, Clemence (Ecole Polytechnique)
Marbach, Peter (University of Toronto)
Munro, Ian (University of Waterloo)
Pelsmajer, Michael (Illinois Institute of Technology)
Tóth, Csaba (UC-Santa Barbara)
Wilfong, Gordon (Bell Labs)

Linear Operators: Theory, Applications and Computations
August 12–14, 2004

Organizers:

Paul Binding (University of Calgary)
Peter Lancaster (University of Calgary)

The theory of matrices and linear operators was going through a highly productive phase driven largely by a great variety of applications. These included magneto-hydrodynamics, vibrations of continua, systems theory, signal processing, for example. They frequently concerned the spectral properties of operators on Krein or Pontryagin spaces, and also required modern techniques in perturbation theory and differential equations. The workshop provided an opportunity for informal discussion and presentation of current research projects in these areas. Participants included H. Langer (Vienna), A. Markus (Beer-Sheva) and L. Rodman (Williamsburg).

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2063/

Participants:

Allegretto, Walter (Dept.of Mathematical Sciences)
Binding, Paul (University of Calgary)
Boulton, Lyonell (University of Calgary)
Browne, Patrick (University of Saskatchewan)
Choi, Man-Duen (University of Toronto)
Churchill, Richard (CUNY)
Farenick, Douglas (University of Regina)
Gibson, Peter (York University)
Lancaster, Peter (University of Calgary)
Langer, Heinz (Vienna University of Technology)
Markus, Alexander (Ben Gurion University)
Rodman, Leiba (College of William and Mary)
Sourour, Ahmed Ramzi (University of Victoria)
Tretter, Christianne (University of Bremen)
Watkins, David (Washington State University)
Xu, Hongguo (University of Kansas)
Zhou, Fei (University of Regina)

Alberta Topology Seminar
August 19–21, 2004

Organizers:

George Peschke (University of Alberta)
Kristine Bauer (University of Calgary)
Peter Zvengrowski (University of Calgary)

This 2-day workshop should be considered within the wider context of the Alberta Topology Seminar (ATS). The ATS is an Alberta based regional effort to strengthen the research environment and to foster research activities of mathematicians working in Topology as well as in its interfaces with Algebra, Analysis, Geometry, and Theoretical Physics. Participants came primarily from the Alberta universities, but also from neighbouring provinces and states. The driving force behind this broad endeavour was the basic fact that research thrives in a climate of rich and multidirectional interaction, generating critical mass for discovery amongst the participants in as many ways as possible. The challenge then was to achieve amongst the participants a level of breadth of expertise and familiarity with each other's works to allow such interaction to take place. Towards this end we have had 12 ATS-meetings during the last year with talks comprising a mix of background building educational presentations, as well as conference style presentations about recent discoveries.
Within this context the 2-day workshop we had at BIRS was by far the most important, extensive, and benecial ATS meeting held to date. The twenty participants formed a healthy mix of established and junior researchers, as well as graduate students representing the Universities of Alberta, Calgary, Lethbridge, and Oregon. We had twelve talks (7 on the rst day, 5 on the second) spanning areas that include low dimensional and transformation group topology, representation theory, algebraic geometry, noncommutative geometry, etc.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2064/

Participants:

Bauer, Kristine (University of Calgary)
Budney, Ryan (University of Oregon)
Chen, Xi (University of Alberta)
Cunningham, Clifton (University of Calgary)
Dover, Lynn (University of Alberta)
Gannon, Terry (University of Alberta)
Krause, Eva Maria (University of Alberta)
Krebes, Dave (University of Calgary)
Morris, Dave (University of Lethbridge)
Nikolaev, Igor (University of Calgary)
Oliveros, Deborah (University of Calgary)
Peschke, George (University of Alberta)
Pianzola, Arturo (University of Alberta)
Ruan, Haibo (University of Edmonton)
Sabbagh, Bouchra (University of Calgary)
Tripathi, Satya Prakash (University of Calgary)
Zvengrowski, Peter (University of Calgary)
von Bergmann, Jens (Michigan State University)

TPI Annual Symposium 2004
September 2–4, 2004

Organizer:

Frank Marsiglio (University of Alberta)

The Theoretical Physics Institute at the University of Alberta consists of members from three different departments (Physics, Mathematical and Statistical Sciences, and Chemistry), and future members may well come from even more diverse backgrounds. We had held an annual symposium the past two years, with this year's held at the BIRS facility (Aug. 28-30). It was deemed an overwhelming success by the attendees. The symposium was designed to bring together members and especially their students and postdoctoral fellows, to enhance interdepartmental exchange and collaboration.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2544/

Participants:

Austen , Dave (University of Alberta)
Ballentine , Leslie (Simon Fraser University)
Betts , Donald (Dalhousie University)
Betts , Patricia (St. Francis Xavier University)
Bowman, John (University of Alberta)
Brouwer, Wytze (University of Alberta)
Brown, Alex (University of Alberta)
Buczek , Pawel (University of Alberta)
Cheng, Taiwang (University of Alberta)
Czarnecki, Andrzej (University of Alberta)
Ditzian, Ruth (University of Chicago)
Elliott, Chuck (Kakari Systems)
Gortel, Zbigniew (University of Alberta)
Gribouk, Taras (University of Alberta)
Hunter, Doug (St. Francis Xavier University)
Isaac, Isaac (University of Alberta)
Israel, Werner (University of Victoria)
Kadanoff, Leo (University of Chicago)
Khanna, Faqir (University of Alberta)
Loly, Peter (University of Manitoba)
Malbouisson, Jorge (University of Alberta)
Marsiglio, Frank (University of Alberta)
Oitmaa , Jaan (University of New South Wales)
Oliynyk, Todd (University of Alberta)
Plischke , Michael (Simon Fraser University)
Romanov, Dmitri (University of Alberta)
Sanders , Barry (University of Calgary)
Santos, Esdras (University of Alberta)
Sherif, Helmy (University of Alberta)
Strungaru, Nicolae (University of Alberta)
Taylor, Keith (Dalhousie University)
Vardarajan, Suneeta (University of Alberta)
Woolgar, Eric (University of Alberta)
Yao, Yushu (University of Alberta)

PIMS Executive Retreat
September 23–25, 2004

Organizer:

Manfred Trummer (Simon Fraser University)

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2545/

Participants:

Ádem, Alejandro (University of British Columbia)
Alvarado, Shelley (PIMS)
Boorman, Michael (PIMS)
Bose, Chris (University of Victoria)
Chen, Gemai (University of Calgary)
Cliff, Gerald (University of Alberta)
Ekeland, Ivar (University of British Columbia)
Ghoussoub, Nassif (University of British Columbia)
Goebel, Randy (University of Alberta)
Hillen, Thomas (University of Alberta)
LeVeque, Randy (University of Washington)
Leeming, David (University of Victoria)
Lind, Doug (University of Washington)
Loyce, Adams (University of Washington)
Macki, Jack (University of Alberta)
Margrave, Gary (University of Calgary)
Moody, Robert (University of Alberta)
Perkins, Ed (University of British Columbia)
Ripley, Robert (Martec Ltd.)
Russell, Bob (Simon Fraser University)
Williams, Hugh (University of Calgary)

Pacific Northwest Numerical Analysis Seminar
September 30–October 2, 2004

Organizers:

Chen Greif (University of British Columbia)
Dominik Schoetzau (University of British Columbia)
Manfred Trummer (Simon Fraser University)

This meeting was the 18th Annual Pacific Northwest Numerical Analysis Seminar (PNWNAS). It was sponsored by the Pacific Institute for the Mathematical Sciences (PIMS) as an event of the period of concentration in scientific computing, and was hosted by BIRS. The PNWNAS meeting has been held every year since 1987,

and was aimed at bringing together people from the Pacific Northwest who are interested in numerical analysis and scientific computing. Details on previous meetings can be found at http://www.amath.washington.edu/~pnwnas/

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2053/

Participants:

Ascher, Uri (University of British Columbia)
Bank, Randy (University of California at San Diego)
Braverman, Elena (University of Calgary)
Bridson, Robert (University of British Columbia)
Calhoun, Donna (University of Washington)
Chen, Wan (University of British Columbia)
Cormier, Sarah (University of British Columbia)
Dennis, John (Rice University)
Fagnan, Kirsten (University of Washington)
Ferng, William (The Boeing Company)
Friedlander, Michael (University of British Columbia)
Genz, Alan (Washington State University)
Greif, Chen (University of British Columbia)
Haws, John (Boeing)
Jung, Jae-Hun (PIMS, University of British Columbia)
Kropinski, Mary-Catherine (Simon Fraser University)
Lamoureux, Michael (University of Calgary)
Lehoucq, Rich (Sandia National Laboratories)
Li, Dan (University of British Columbia)
Minev, Peter (University of Alberta)
Mitchell, Ian (University of British Columbia)
Oberman, Adam (Simon Fraser University)
Overton, Michael (New York University)
Quaife, Bryan (University of Calgary)
Restrepo, Juan (University of Arizona)
Ruuth, Steve (Simon Fraser University)
Schoetzau, Dominik (University of British Columbia)
Tang, Wei-Pai (Boeing)
Taylor, Andrew (University of Calgary)
Trummer, Manfred (Simon Fraser University)
Varah, Jim (University of British Columbia)
Wang, Dong (Simon Fraser University)
Ware, Antony (University of Calgary)
Watkins, David (Washington State University)
Wigton, Laurence (Boeing)
Yedlin, Matt (University of British Columbia)
Zhang, Jianying (University of British Columbia)

Data Mining MITACS Industry Session
October 14–16, 2004

Organizer:

Jim Brookes (MITACS)

The goals of this workshop included: Network individuals from industry and academia who are interested in both data mining research and the application of advanced techniques in data mining; Share experiences from industrial participants on key issues in the application of data mining and from academia on current research results; Establish future research priorities for data mining; Create new opportunities for research collaborations between industry and academia

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2065/

Participants:

Ben-David, Shai (University of Waterloo)
Bengio, Yoshua (University of Montreal)
Boire, Richard (Boire Filler Group)
Ciampi, Antonio (McGill University)
Dzieciolowski, Krzysztof (Bell Canada)
Ester, Martin (Simon Fraser University)
Huang, Jiayuan (University of Waterloo)
Kourti, Theodora (McMaster University)
Ling, Daymond (CIBC)
Lucas, Jeff (MITACS)
Makos, Rick (Teradata Canada)
McDonald, Hugh (Intrawest Corporation)
Pei, Jian (University of Buffalo, New York)
Sander, Joerg (University of Alberta)
Sayyad-Shirabad, Jelber (University of Ottawa)
Schuurmans, Dale (University of Alberta)
Storey, Andrew (Scotiabank)
Taciuk, Terry
Tompa, Frank (University of Waterloo)
Trummer , Manfred (Simon Fraser University)
Wang, Ke (Simon Fraser University)
Zamar , Reuben (University of British Columbia)

Canadian Mathematical Leadership Retreat
October 28–30

Organizer:

Nassif Ghoussoub (University of British Columbia)

Participating organizations included: hours) Introduction and 5 minute overview by each participating organizations: Canadian Mathematical Society(CMS), Canadian Applied and Industrial Mathematics Society(CAIMS), Statistical Society of Canada, Centre de recherches mathématiques (CRM), Fields Instiute (FI), the Pacific Institute for the Mathematical Sciences (PIMS), Atlantic Association for Research in the Mathematical Sciences (AARMS), Banff International Research Station (BIRS) , the Mathematics of Information Technology and Complex systems (MITACS), Institut des Sciences Mathematiques (ISM)

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2067/

Participants:

Ali, Twareque (Institut des Sciences Mathematiques)
Brunner, Hermann (MUN)
Campbell, Eddy (MUN)
Davidson, Kenneth R. (University of Waterloo)
Ekeland, Ivar (University of British Columbia)
Ghoussoub, Nassif (University of British Columbia)
Gupta, Arvind (MITACS)
Jackson, Ken (CAIMS)
Kane, Richard (University of Western Ontario)
Keyfitz, Barbara Lee (Fields Institute)
Lalonde, Francois (University of Montreal)
Langford, Bill (Canadian Applied and Industrial Mathematics Society)
Reid, Nancy (University of Toronto)
Rousseau, Christiane (University of Montreal)
Thompson, Mary E. (University of Waterloo)

MITACS Theme Meeting: Communication Networks and Security
November 4–6, 2004

Organizer:

Evangelos Kranakis (Carleton University)

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2069/

Participants:

Bae, Jung (Dalhousie University)
Barbeau, Michel (Carleton University)
Clark, Nancy (Acadia University)
Coutelen, Thomas (Université de Montréal)
Dyer, Danny (University of Regina)
Elbiaze, Halima (Université de Montréal)
Hahn, Gena (Université de Montréal)
Hall, Jeyanthi (Carleton University)
Hirt, Andreas (University of Calgary)
Hoyer, Peter (University of Calgary)
Jaumard, Brigitte (Université de Montréal)
Kalyaniwalla, Nauzer (Dalhousie University)
Kerherve , Brigitte (Université de Montréal)
Kranakis, Evangelos (Carleton University)
Leung, Henry (University of Calgary)
Liu, Hongyu (Dalhousie University)
Majumdar, Deyasini (University of Calgary)
Metnani, Ammar (Université de Montréal)
Nie , Xiaojun (Carleton University)
Nowakowski, Richard (Dalhousie University)
Scott, Andrew (University of Calgary)
Shanmugam, Surendran K. (University of Calgary)
Somayaji, (Carleton University)
Venkatasubramanian, Vijayaraghavan (University of Calgary)
Walgate, Jonathan (University of Calgary)
Williams, Hugh (University of Calgary)
Wooding, Kjell (University of Calgary)
Yang, Boting (University of Regina)
Zhao, Yiqiang (Carleton University)
Zou, Shaoying (Carleton University)

MITACS Project Meeting: Modelling Trading and Risk in the Market
November 11–13, 2004

Organizer:

Tony Ware (University of Calgary)

The workshop aimed to bring academic researchers in mathematical and computational finance and together with risk managers and quantitaive analysts from industry to share new ideas, practical and theoretical questions of the moment, current research, and to foster closer collaboration.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2070/

Participants:

Davison, Matt (University of Western Ontario)
Dmitrasinovic-Vidovic, Gordana (University of Calgary)
Elliott, Robert (University of Calgary)
Grasselli, Matheus (McMaster University)
Hurd, Thomas (McMaster University)
Seco, Luis (University of Toronto)
Swishchuk, Anatoliy (University of Calgary)
Ware, Tony (University of Calgary)

Number Theorists Weekend
November 18–20, 2004

Organizer:

Michael Bennett (University of British Columbia)

This short workshop focused on developments in Number Theory at the interface of Computational Methods with Analytic Number Theory and Diophantine Approximation. These represented two particular strengths of the Canadian mathematical community in general, and of the PIMS region in particular. The workshop was designed as a bridge between the Computational workshop preceding it and that in Analytic Number Theory and Diophantine Approximation which followed. An emphasis was placed on expository talks with graduate student and postdoctoral fellow involvement highlighted.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2505/

Participants:

Bauer, Mark (University of Calgary)
Bennett, Michael (University of British Columbia)
Bernstein, Daniel (University of Illinois, Chicago)
Chou, James (University of Calgary)
Cohen, Paula (Texas A&M University)
Corvaja, Pietro (University of Udine)
David, Chantal (Concordia University)
Dembele, Lassina (University of Calgary)
Ellenberg, Jordan (Princeton University)
Ferguson, Ron (Simon Fraser University)
Filaseta, Michael (University of South Carolina)
Foster, Chris (University of Calgary)
Guy, Richard (University of Calgary)
Helfgott, Harald (Yale University)
Lemieux, Stephane (University of Calgary)
Lobnig, Tanja (University of Calgary)
Martin, Greg (University of British Columbia)
Mulholland, Jamie (University of British Columbia)
Patterson, Roger (University of Calgary)
Pinch, Richard (HMG, Cheltenham)
Roettger, Eric (University of Calgary)
Rozenhart, Pieter (University of Calgary)
Scheidler, Renate (University of Calgary)
Silvester, Alan (University of Calgary)
Sullivan, Nick (University of Calgary)
Tang, Adrian (University of Calgary)
Venkatesh, Akshay (MIT)
Wooding, Kjell (University of Calgary)

MITACS Environment and Natural Resources Theme Meeting
December 2–4, 2004

Organizer:

John Stockie (Simon Fraser University, MITACS)

Some of the most challenging problems being studied today involved coupling between various nonlinear physical phenomena which occur on a wide range of spatial and temporal scales. The primary tool for studying such complex problems was numerical simulation. A plethora of new methods had been developed in recent years which aim to deal with problems of stiffness inherent in multiscale problems. However, more research was needed in order to develop more efficient algorithms which were specially tailored for individual problems.

The projects within the MITACS Environment and Natural Resources Theme spanned a diverse range of application areas, involving fuel cells, seismic imaging, spatio-temporal population dynamics, and computational fluid dynamics. However, these projects were connected by their common need for numerical methods that solve differential and integro-differential equations. Several projects within this theme were leading the development of such methods, and so we plan to provide a forum for discussing these recent advances in numerical methods, and to share expertise between the participants. There was also a recognized need for development of more expertise in parameter sensitivity analysis, which was an essential technique for understanding the dependence of such complex models on important system parameters.

The purpose of this workshop was to bring together the projects participating in this theme for the first time, and to explore common interests related to recent advances in numerical methods for differential (and integro-differential) equations.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04w2066/

Participants:

Ahn, Hojun (University of Waterloo)
Barsky, Sandra (University of British Columbia)
Bourlioux, Anne (University of Montreal)
Bouzidi, Youcef (Geo-X Systems Ltd.)
Bridge, Lloyd (University of British Columbia)
Carnes, Brian (University of Victoria)
Chang, Paul (University of British Columbia)
Chen, Wan (University of British Columbia)
Fishman, Lou (University of Calgary/MDF International)
Geiger, Hugh (University of Calgary)
Gibson, Peter (York University)
Josey, Tyson (Martec Ltd.)
Lamoureux, Michael (University of Calgary)
Lien, Fue-Sang (University of Waterloo)
Margrave, Gary (University of Calgary)
Montgomery, Patrick (UNBC)
Muir, Paul (Saint Mary's University)
Nyquist, Brock (Okanagan University College)
Patera, Jiri (Universite de Montreal)
Petzold, Linda (University of California)
Promislow, Keith (SFU/Michigan State University)
Shah, Akeel (Simon Fraser University)
Spiteri, Ray (University of Saskatchewan)
Stockie, John (Simon Fraser University, MITACS)
Tuy, Rosette (University of Saskatchewan)
Tyson, Rebecca (Okanagan University College)
Wang, Rong (University of Saskatchewan)
Watmough, James (University of New Brunswick)
Wetton, Brian (University of British Columbia)
Zhao, Xiao-Qiang (Memorial University of Newfoundland)

Banff International Research Station

2004

Summer Schools

Research In Teams

Focused Research Groups

PIMS-MITACS-MSRI Special Program on Infectious Diseases Summer School June 19–27, 2004

Organizer:

Fred Brauer (University of British Columbia)
Mark Lewis (University of Alberta)
Pauline van den Driessche (University of Victoria)
James Watmough (University of New Brunswick)
Jianhong Wu (York University)
Ping Yan (Health Canada)

This special program on Infectious Diseases at BIRS was to continue the success of the MITACS-PIMS Health Canada Meeting on SARS in furthering the fruitful interplay among mathematical, statistical, and epidemiological sciences, and to provide effective training for graduate students and junior researchers in the collaborative research in infectious diseases based on mathematical modeling and qualitative analysis. The program, organized by the MITACS project Transmission Dynamics and Spatial Spread of Infectious Diseases: Modeling, Prediction and Control, consisted of a Summer School (for graduate students and beginning postdoctoral fellows) June 19 - June 27 followed by a Research Conference June 28 - July 2, 2004.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04ss101/

Participants:

Allen, Linda (Texas Tech University)
Arino, Julien (McMaster University)
Azer, Nancy (University of Victoria)
Bauch, Chris (University of Guelph)
Brauer, Fred (University of British Columbia)
Castillo-Chavez, Carlos (Arizona State University)
Chang, Shan (University of Victoria)
Chen, Wei (Université de Montréal)
Choo, Karen (Queen's University)
Corbett, Brian (University of Manitoba)
Davis, Brad (University of British Columbia)
Deering, Kathleen
Dueck, Stephen (University of Manitoba)
Earn, David (McMaster University)
Fan, Guihong (McMaster University)
Feng, Runhuan (Concordia University)
Heffernan, Jane (University of Western Ontario)
Hill, Jessica (University of British Columbia)
Hsu, Chia-Yu (Washington State)
Jiang, Li (University of Victoria)
Klepac, Petra (Woods Hole Oceanographic Institute)
Larochelle, Francois (Carleton University)
Lewis, Mark (University of Alberta)
Lim, Gillian (University of Toronto)
Liu, Maoxing (North China University of Science and Technology)
Liu, Rongsong (York University)
Ma, Brian (Simon Fraser University)
MacKinnon, Ryan (Carleton University)
Mapes, Eric (Washington State)
Michael, James (Duke University)
Mubayi, Anuj (Arizona State University)
Nettel-Aguirre, Alberto (Unviersity of Calgary)
Ortega, Omayra (University of Iowa)
Pereira, Audrey (University of Guelph)
Rapatski, Brandy (University of Maryland)
Reluga, Timothy (University of Washington)
Richards, Stephanie (University of Manitoba)
Salmani, Mahin (University of Victoria)
Shim, Alicia (University of British Columbia)
Teng, Xia (University of New Brunswick)
Wagner, Brad (McMaster University)
Wang, Lin (McMaster University)
Watmough, James (University of New Brunswick)
Weiss, Leda Ivic (York University)
Williams, Paul (University of Toronto)
Wu, Jianhong (York University)
Yan, Ping (Health Canada)
Zeng, Qingling (York University)
Zhang, Fang (Memorial university of Newfoundland)
Zhao, Yan (Vanderbilt University)
Zhou, Yicang (York University)
Zhu, Jiaping (University of Victoria)
van den Driessche, Pauline (University of Victoria)

PIMS-MITACS-MSRI Special Program on Infectious Diseases Summer School June 27–July 2, 2004

Organizer:

Fred Brauer (University of British Columbia)
Ying-Hen Hsieh (National Chung Hsing University)
Mark Lewis (University of Alberta)
Pauline van den Driessche (University of Victoria)
James Watmough (University of New Brunswick)
Jianhong Wu (York University)
Ping Yan (Health Canada)
Xiao-Qiang Zhao (Memorial University of Newfoundland)

For details, please refer to the webpage:
http://www.pims.math.ca/birs/workshops/2004/04ss100/

Participants:

Allen, Linda J. S.
Arino, Julien (McMaster University)
Bauch, Chris (University of Guelph)
Blower, Sally (UCLA School of Medicine)
Bowman, Christopher (National Research Council, Government of Canada)
Brauer, Fred (University of British Columbia)
Choo, Karen (Queens University)
Chowell, Gerardo (Cornell University)
Cuff, Wilfred (Health Canada)
Day, Troy (Queen's University)
Dueck, Stephen (University of Manitoba)
Earn, David (McMaster University)
Galvani, Alison (UC-Berkeley)
Glasser, John (Centers for Disease Control and Prevention)
Gumel, Abba (University of Manitoba)
Hsieh, Ying-Hen (National Chung Hsing University)
Jolly, Ann (Health Canada)
Li, Michael (University of Alberta)
Liu, Maoxing (North China University of Science and Technology)
Liu, Rongson (York University)
Park, Andrew (York University)
Pourbohloul, Babak (UBC, Centre for Disease Control)
Rapatski, Brandy(University of Maryland)
Reluga, Timothy (University of Washington)
Sahai, Beni (Cadham Provincial Laboratory)
Shim, Alicia (UBC)
Trummer, Manfred (Simon Fraser University)
van den Driessche, Pauline (University of Victoria)
Wang, Lin (University of Victoria)
Watmough, James (University of New Brunswick)
Weiss, Leda (University of Toronto)
Williams, Paul (University of Toronto)
Wu, Jianhong (York University)
Yan, Ping (Health Canada)
Zeng, Qingling (York University)
Zhou, Yicang (York University)
Zhu, Huaiping (York University)

Cohomogeneity One Manifolds with Positive Sectional March 13 - 27, 2004

Organizers/ Participants:

Karsten Grove (University of Maryland)
Burkhard Wilking (University of Muenster)
Wolfgang Ziller (University of Pennsylvania)

Manifolds with positive sectional curvature have been of much interest since the beginning of global Riemannian geometry. There are very few examples with positive sectional curvature, in fact in dim>24 only the rank one projective spaces are known, i.e. S^n, RP^n,CP^n, and CaP^2. Below this dimension one knows some homogeneous examples in dim 6,7,12,13,24 due to Berger, Aloff and Wallach and some biquotients due to Eschenburg and Bazaikin. Any new examples, which would require new techniques to find them, would be very interesting.

The next natural class of manifolds to look at were the so called cohomogeneity one manifolds where the generic orbits of the group action are hypersurfaces. The goal of this project was to classify all cohomogeneity one manifolds which admit an invariant metric of positive curvature, which hopefully would produce new examples. The construction of such metrics in any new candidates would be especially challenging. The three participants all had considerable expertise in dealing with the problems involved.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04rit525/

Modular invariants and NIM-reps March 13 - 27, 2004

Organizers/Participants:

Matthias Gaberdiel (Kings College, London, UK)
Terry Gannon (University of Alberta)

We are interested in the relation between the modular invariant partition functions, and the NIM-reps, associated to affine nontwisted Kac-Moody algebras *g*. Almost every possible partition function of *g* is closely related to the data associated to *g*, e.g. its Dynkin diagram. Ideally, the same will hold with the NIM-reps of *g*, at least those NIM-reps compatible with a partition function. We will aim to find explicit constructions of those NIM-reps, and if possible interpret the results in terms of the underlying Lie algebras, exactly as we did in [15] for a certain class of partition functions. One of our new tools is a sort of induction we have recently developed, lifting a NIM-rep from a smaller fusion ring to an extension.

An indication of the relevance, importance, and timeliness of our proposed topic is the large number of papers published on this in the past 3-4 years, by leading researchers.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04rit048/

Pi in the Sky Meeting
May 13 - 15, 2004

Organizer:

Heather Jenkins (Pacific Institute for the Mathematical Sciences)

Editorial board meeting for *Pi in the Sky*, a publication devoted to enrichment of education and public awareness in the mathematical sciences.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/04rit300/

Participants:

Bowman, John (University of Alberta)
Diacu, Florin (University of Victoria)
Ekeland, Ivar (Pacific Institute for the Mathematical Sciences)
Hoechsmann, Klaus (Pacific Institute for the Mathematical Sciences)
Hrimiuc, Dragos (University of Alberta)
Jenkins, Heather (Pacific Institute for the Mathematical Sciences)
Krawcewicz, Wieslaw (University of Alberta)
Lagu, Indy (University of Calgary)
Lamoureux, Michael (University of Calgary)
Leeming, David (University of Victoria)
Runde, Volker (University of Alberta)

Maximal functions in non-commutative analysis
May 15 - June 5, 2004

Organizers/ Participants:

Marius Junge (University of Illinois)
Quanhua Xu (Université de Franche-Comté)

This program had two main objectives. First, the progress in the theory of non-commutative martingale inequalities strongly supports the belief that this might open a door to the study of the operator space Radon-Nykodym property, the analogue for operator spaces of the usual Radon-Nykodym property in the category of Banach spaces. This notion was introduced by Pisier [Ps], and since then very few has been known, and many problems are left open. Armed with the techniques from non-commutative martingale theory, we would be able to give a satisfactory study of this property. We would also consider two related properties introduced by Pisier in the category of operator spaces, namely, the operator space uniform convexity (see also [Ef]) and UMD property.

Second, again due to the progress mentioned above and the classical connection between harmonic analysis and martingale theory, it is reasonable to expect more progress in the general context of non-commutative analysis. Indeed, very recently the P.I.'s of this program obtained a non-commutative version of the inequality on the radial maximal function in harmonic analysis.

We hoped that this line of research would tighten the connection between classical analytic problems and more recent operator algebraic tools developed to understand these analytic problems in a non-commutative framework (similar as in the work of Connes but with a different focus). As a long term goal, we hoped to draw the attention of researchers in mathematical physics or classical probability. The progress in this very recent line of research may indicated that this field was on his way to obtain relevance on a larger scale (as of now many result were just accepted for publication and thus only known to a relatively small group experts).

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit004/*

Geometric Analysis of One and Several Complex Variables
May 22 - June 5, 2004

Organizers/ Participants:

Joseph Cima (University of North Carolina)
Ian Graham (University of Toronto)
Kang-Tae Kim (Pohang Institute of Science and Technology, Korea)
Steven G. Krantz (Washington University in St. Louis)

Our goal was to develop our mutual interests in holomorphic mappings, boundary uniqueness, automorphism groups, normal families, and related ideas. We wished to find a stricly geometric proof of the Burns/Krantz theorem. We wished to make progress on the Greene/Krantz conjecture. We wished to develop the circle of ideas connected with boundary uniqueness of holomorphic mappings. We wanted to flesh out the now nascent theory of holomorphic mappings on Hilbert space and Banach space.

These questions were central to the geometric function theory of several complex variables and the answers were startlingly different in the multi-variable setting from the one-variable setting. But it should be stressed that one-variable techniques could play an important role in solving these problems. Cima and Krantz had had notable success, both separately and in collaboration, using this approach. Graham had also developed remarkable insights from this point of view.

The four participants in the workshop were colleagues and collaborators of long standing. They worked and communicated well together. The time at BIRS was productive.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit524/*

Geometry and Deformation Theory of Hyperbolic
July 3 - 10, 2004

Organizers/ Participants:

Jeffrey Brock (Brown University)
Kenneth Bromberg (University of Utah)
Richard Canary (University of Michigan)
Yair Minsky (Yale University)

These results taken in total represent a paradigm shift in the study of infinite volume hyperbolic 3-manifolds. Our aim for the research in teams was to reexamine the state of the field and attempt to define and explore new direction for future research in the field. The field is far from exhausted, and the methods and techniques that arise in the above results have already begun to point to new questions that can be fruitfully approached for the first time. In our meeting we would seek to explore these new questions, and reassess the state of some older questions with the modern perspective that we have managed to develop.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit057/*

Stability and Computations for Stochastic Delay-Differential Equations
July 24 - August 7, 2004

Organizer:

Rachel Kuske (University of British Columbia)

The purpose of this research in teams was to explore the complementary nature of the computational, semi-analytical, and theoretical approaches described above, and to develop new combined explorations of stability of SDDE's. We had met together in pairs or as a group briefly at conferences, and we had several proposed projects. For example, Kuske's analysis described reduced models for describing the attracting behavior of the system, in which the influence of the noise and delay are easily identified. Buckwar and Shardlow's work identified conditions under which this attracting behavior is stable in a numerical simulation. Mohammed had recent theoretical results on higher order methods, as well as bounds on Lyapunov exponents for certain types of noise, also related to the models studied by Kuske and Buckwar.

The experts in this Research in Teams project are familiar with the class of problems which are of interest in applications and computations. They have several canonical examples which are excellent starting points for developing a unified approach toward understanding stability and dynamics in stochastic delay-differential equations. Such an approach is necessary as the use of these models increases in practice.

The research team had a concentrated time to work together to bring together their different areas of expertise. There were some working seminars, which reviewed results on an expert level and proposed areas of joint work. Then the researchers would select some project(s) on which to focus, using the time to make significant progress in these directions.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit047/*

Participants:

Buckwar, Evelyn (Humboldt University)
Kuske, Rachel (University of British Columbia)
Mohammed, Salah (South Illinois University - Carbondale)
Shardlow, Tony (University of Manchester)

Study of Affine Surfaces with Self-maps of Degree > 1 and the Jacobian Problem
July 24 - August 14, 2004

Organizer/ Participants:

R.V. Gurjar (Tata Institute of Fundamental Research, India)
M. Miyanishi (Osaka University)
Masayoshi Miyanishi (Kwansei Gakuin University)
Peter Russell (Mcgill University)
D.-Q. Zhang (National University of Singapore)

Our project consisted of two related topics. 1) Classification of smooth affine surfaces which admit a proper endomorphism of degree > 1. 2) Study of smooth affine surfaces which admit an etale self-map, with eventual application to the Jacobian problem.

We felt that our methods were quite sophisticated and would give very good results in the end. A close look at both of these problems showed that the study of affine rational surfaces was at the heart of the matter. The research work of the three of us, both individually and jointly, involved affine rational surfaces in essential ways. So we were well-equipped to attack these problems.

We had been collaborating since 1985 in pairs. Since our interests had now converged on the above two questions, we felt that it would be best if all three of us work together at the same time. BIRS was an ideal place for such a joint work.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit553/*

Competing Species and Predator-Prey Models and Measured-valued Diffusions
August 1 - 14, 2004

Organizer:

Ed Perkins (University of British Columbia)

Durrett and Levin (1996) introduced a class of multitype contact processes in which particles die at a rate proportional to the local size of the other types (competition) and give birth to a nearby unoccupied site at a fixed rate. Evans and Perkins (1994,1998) studied a class of measure-valued processes in which two populations undergoing critical reproduction and random migration compete for resources when they are in contact with each other. In the particularly simple case of the Durrett-Levin model in which one bacteria has an adverse effect on the other but not conversely, Durrett conjectured that a rescaled version of the Durrett-Levin model should converge to the corresponding simple case of the Evans-Perkins model. Durrett and Perkins (unpublished notes) confirmed this conjecture but noted that the limit theorem should hold quite generally for two competing populations. One of the key results to carry this out was obtained by Mytnik (1999) when he showed that a large class of the Evans-Perkins models (the symmetric ones) were unique in law. Over the years Durrett, Mytnik and Perkins have been working in pairs on this problem and may (or may not) have a solution at least in the symmetric case. Along the way the class of models has grown to include predator-prey interactions in which close encounters benefit one type of particle and are detrimental to the other. We had a number of ideas on how to show all limit points satisfy a particular martingale problem. Time in Banff allowed us to consolidate these ideas and tackle the difficult open uniqueness questions for the predator-prey limits which would be needed to complete the convergence result.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit050/*

Participants:

Durrett, Richard (Cornell University)
Mytnik, Leonid (Technion)
Perkins, Ed (University of British Columbia)

Geometry and Analysis on Cauchy Riemann Manifolds
September 4 - 18, 2004

Organizer:

John Bland (University of Toronto)
Tom Duchamp (University of Washington)
Charlie Epstein (University of Pennsylvania)
John M Lee (University of Washington)

In recent years very significant results in Cauchy-Riemann geometry (i.e., CR geometry) have been obtained, relating for example the embeddability of CR manifolds which arise as separating hypersurfaces in algebraic varieties to the extendability of structures to the pseudoconcave (pseudoconvex) side. These results opened up a new vista, but many problems remain open.

One of the central problems of local CR geometry is the embeddability question. For the case of real dimension at least 9, Kuranishi solved the problem by L^2 estimates. The case of real dimension 7 was solved by Akahori by refining Kuranishi's method, and later reproved by Webster by using the Henkin kernel. Since then a host of additional techniques have been developed for the local embedding of CR manifolds. A related question is the global embeddability of CR manifolds and its relation to the local deformation theory of isolated singularities, or the Kuranishi program. The most challenging part of the problem is to study conditions of embeddability for the case of real dimension 3. New techniques give many partial results for the case of real dimension 3, but there is not yet a completely satisfactory solution of the problem. Moreover, the partial results open many new avenues for investigating the relationships between function theory for pseudoconcave manifolds and CR deformation theory for the boundary.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit554/*

Participants:

Bland, John (University of Toronto)
Duchamp, Tom (University of Washington)
Garfield, Peter (Case Western Reserve University)
Hladky, Robert K. (Dartmouth College)
Lee, John M (University of Washington)

Research on stochastic models for the Web graph and other scalefree networks
September 18 - 25 2004

Organizers/ Participants:

Anthony Bonato (Wilfrid Laurier University)
Jeannette Janssen (Dalhousie University)

The study of web graph models is a rapidly evolving field. Bonato and Janssen started working on this subject in 2002, and had made some initial contibutions to the field by studying the infinite limits of the proposed models. This work resulted in one accepted paper, and another one in progress. However, their work was in the stage where intense personal contact was necessary to push their work further. BIRS provided an ideal environment to generate a host of new ideas, which could then be refined through email correspondence and occasional short visits.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04rit060/*

Focused Research Groups

Robust Analysis of Large Data Sets
June 5 - 19, 2004

Organizers/ Participants:

Stefan Van Aelst (Ghent University)
Reuben Zamar (University of British Columbia)

Traditional statistical theory mainly deals with the uncertainty of estimates and predictions in the presence of sampling variability. On the other hand, the increasing computing and storage capacity of computers creates the need for thorough statistical analysis of large databases including very large amount of data of uneven quality. Therefore, the issue of "data quality" as opposed to "data quantity" becomes more and more important. This is particularly true in the case of large scientific databases (e.g. statistical genetics-Microarray data) and in the process of economical decision making (e.g. company policy based on knowledge obtained from customer database).

The purpose of the workshop was to bring together a group of scientists that had expressed their interest in the analysis of large complex databases including data of uneven quality. Due to the increasing size of databases the demand for such methods was pertinent and urgent. By exchanging ideas, viewpoints and experience, all aspects of the problem would be addressed in a constructive manner such that significant progress became possible.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04frg501/*

Participants:

Croux, Christophe (Katholieke Universiteit Leuven)
Field, Chris (Dalhousie University)
Filzmoser, Peter (Vienna University of Technology)
Gather, Ursula (Universitt Dortmund)
Genton, Marc (North Carolina State University)
He, Xuming (University of Illinois at Urbana-Champaign)
Hennig, Christian (Universitat Hamburg - SPST/ZMS)
Maronna, Ricardo (Universidad Nacional La Plata)
Martin, Doug (University of Washington)
Ronchetti, Elvezio (University of Geneva)
Salibian-Barrera, Matias (Carleton university)
Tyler, David (Rutgers University)
Van Aelst, Stefan (Ghent University)
Wei, Ying
Willems, Gert (University of Antwerp)
Yohai, Victor (University of Buenos Aires)
Zamar, Reuben (University of British Columbia)

String Field Theory Camp
July 10 - 24, 2004

Organizer:

Moshe Rozali (University of British Columbia)
Gordon Semenoff (University of British Columbia)
Mark Van Raamsdonk (University of British Columbia)
Anastasia Volovich (Institute for Advanced Study)

The research groups at UBC interested in strings and in the sphere of the APCTP in Korea have forged a strong connection over the years. They have collaborated in organizing worshops in Canada and the Winter School in Korea. They have had an informal research collaboration over the years. Part of the rationale for this workshop was to solidify this collaboration with a period of intensive work. The intended product of the collaboration was outstanding original research on string field theory.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04frg538/*

Participants:

Berenstein, David (IAS Princeton)
Brecher, Dominic (UBC & PIMS)
Kitazawa, Yoshi (KEK Lab)
Lee, Taejin (Kangwon National University)
Matsuo, Yutaka(University of Tokyo)
Mikhailov, Andre (California Institute of Technology)
Minwalla, Shiraz (Harvard University)
Peet, Amanda (University of Toronto)
Semenoff, Gordon (University of British Columbia)
Spradlin, Marcus (UC-Santa Barbara)
Taylor, Washington (MIT)
Van Raamsdonk, Mark (University of British Columbia)
Volovich, Anastasia (Institute for Advanced Study)

Kinetic models for multiscale problems
August 21 - September 4, 2004

Organizer:

Reinhard Illner (University of Victoria)
Peter Markowich (Wolfgang Pauli Institute Vienna)
Lorenzo Pareschi (University of Ferrara, Italy)
Jin Shi (University of Wisconsin, Madison)

This research group worked on kinetic modelling of partial differential equations for multiscale problems. The group consisted of researchers whose work was mainly orientated in analytical techniques and of researchers specialized in modeling and numerical techniques. The important objective of this focused research group was to combine modeling, analytical and numerical insights in order to push the frontier of understanding kinetic systems. The interaction of these three areas would be very tight since modern PDE modeling/analysis and numerics/simulation cannot survive without one another in the near future.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2004/*04frg049/*

Participants:

Bao, Weizhu (National University of Singapore)
Illner, Reinhard (University of Victoria)
Li, Xiantao (Princeton University)
Markowich, Peter (Wolfgang Pauli Institute Vienna)
Pareschi, Lorenzo (University of Ferrara, Italy)
Russo, Giovanni (Universita' di Catania)
Schmeiser, Christian (Institut fuer Analysis und Scientific Computing)
Shi, Jin (University of Wisconsin, Madison)
Teismann, Holger (Acadia University)

Banff International Research Station

2005

5-day Workshops

Dynamics, Probability, and Conformal Invariance
March 12–17, 2005

Organizers:

Ilia Binder (University of Toronto)
Peter Jones (Yale University)
Steffen Rohde (University of Washington)
Michael Yampolsky (University of Toronto)

The study of dynamics in the plane has recently seen a surge in interest due to three recent breakthroughs: the Sullivan-McMullen-Lyubich proof of the Feigenbaum Universality, the introduction by O. Schramm of SLE processes, and the work of S. Smirnov on percolation. The fields of Holomorphic Dynamics, SLE, and Conformal Field Theory (CFT) are now seen to be closely linked, the glue being provided by renormalization arguments, conformal mappings, Brownian Motion, and other methods related to Conformal Invariance. Indeed, there is an emerging field where these different dynamical processes, as well as more classical areas in conformal mappings, are unified into a more general theory. Though it is still early in the game, much progress has been made. The workshop brought together leading experts from the areas of SLE, Holomorphic Dynamics, Probability Theory, and Conformal Mappings to present the latest developments in these areas and search for further unification of the fields.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5009/

Participants:

Angel, Omer (University of British Columbia)
Astala, Kari (University of Helsinki)
Beliaev, Dima (KTH, Sweden)
Benedicks, Michael (Royal Institute of Technology, Sweden)
Binder, Ilia (University of Toronto)
Braverman, Mark (University of Toronto)
Brydges, David (University of British Columbia)
Burdzy, Krzysztof (University of Washington)
Cheritat, Arnaud (Universite Paul Sabatier, Toulouse)
Dubedat, Julien (Courant Institute)
Duplantier, Bertrand (Saclay, France)
Eremenko, Alexandre (Purdue University)
Gaydashev, Denis (University of Toronto)
Jones, Peter (Yale University)
Kang, Nam-Gyu (MIT)
Kennedy, Tom (University of Arizona)
Kenyon, Richard (University of British Columbia)
Lind, Joan (University of Washington)
Lyubich, Mikhail (Toronto and Stony Brook)
Makarov, Nick (Caltech)
Marshall, Donald (University of Washington)
Meyer, Daniel (University of Michigan)
Minsky, Yair (Yale University)
Poltoratski, Alexei (Texas A&M University)
Ransford, Thomas (Laval University)
Rohde, Steffen (University of Washington)
Saint-Aubin, Yvan (University of Montreal)
Schramm, Oded (Microsoft Research)
Slade, Gordon (University of British Columbia)
Smirnov, Stas (University of Geneva)
Yampolsky, Michael (University of Toronto)
Zinsmeister, Michel (Université d'Orléans)

Computational Fuel Cell Dynamics-III
March 19–24, 2005

Organizers:

Keith Promislow (Michigan State University)
Jean St-Pierre (Ballard Power Systems)
Brian Wetton (University of British Columbia)

The development of an accurate computational unit cell model, capable of robustly describing the operation over a wide range of conditions is considered to be the heart of the fuel cell modeling effort. Around this centre, we consider a number of issues crucial to its success: identification and validation of appropriate macroscopic models for the complex subsystems of a unit cell; experimental techniques to validate models and extract important material parameters; the identification of new materials that improve performance and/or lower cost.

The CFCD workshops hosted by Ballard Power Systems and PIMS at Simon Fraser University in June 2001, and at BIRS in April 2003, brought together a diverse mix of scientists and engineers to exchange expertise and to find common ground, and provided future research directions. The CFCD III workshop in 2005 was a continuation of these efforts, providing a forum where the latest fuel cell knowledge and technologies can be shared, and focusing the multi-disciplinary efforts of its participants. This important work would certainly lead to the development of a new generation of analytical and computational tools for PEM fuel cell design, and ultimately the realization of the hydrogen economy.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5073/

Participants:

Andreaus, Bernhard (Simon Fraser University)
Baker, Daniel (General Motors, Fuel Cell Applications)
Benziger, Jay (Princeton University)
Berg, Peter (University of Ontario)
Beuscher, Uwe (W.L. Gore & Associates, Inc.)
Birss, Viola (University of Calgary)
Bradean, Radu (Ballard Power Systems)
Buchi, Felix (Paul Scherrer Institute)
Carnes, Brian (University of Victoria)
Chang, Paul (University of British Columbia)
Fuhrmann, Juergen (Weierstrass Institute Berlin)
Haas, Herwig (Ballard Power Systems)
Jain, Rajeev (University of Kansas)
Ju, Hyunchul (Penn State University)
Kenna, John (Ballard Power)
Kim, Gwang-Soo (Ballard Power Systems)
Kimball, Erin (Princeton University)
Kulikovsky, Andrei (Research Center Juelich, IWV-3)
Li, Xianguo (University of Waterloo)
Liu, Chun (Pennsylvania State University)
Liu, Simon (NRC Institute for Fuel Cell Innovation)
Milton, Graeme (University of Utah)
Novruzi, Arian (University of Ottawa)
Pharoah, Jon (Queen's University)
Promislow, Keith (Michigan State University)
Rubinstein, Isaak (J. Blaustein Institute for Desert Research)
Schaefer, Tobias (The City University of New York)
Schumacher, Juergen (Fraunhofer Institute for Solar Energy Systems)
Shimpalee, Sirivatch (University of South Carolina)
St-Pierre, Jean (Ballard Power Systems)
Stockie, John (Simon Fraser University)
Struchtrup, Henning (University of Victoria)
Van Zee, John (University of South Carolina)
Weber, Adam (Lawrence Berkeley National Laboratory)
Wetton, Brian (University of British Columbia)
Xue, Guangri (Pennsylvania State University)
Zhang, Ziheng (University of New Brunswick)
Ziegler, Christoph (Fraunhofer Institute for Solar Energy Systems)

Representations of Kac-Moody Algebras and Combinatorics
March 26–31, 2005

Organizers:

Vyjayanthi Chari (University of California, Riverside)
Gerald Cliff (University of Alberta)
Peter Littelmann (University of Wuppertal)
Nicolai Reshetikhin (University of California, Berkeley)

The particular focus of this workshop was on the combinatorial aspects of representation theory. It brought together senior mathematicians working in the representation theory of Kac-Moody algebras with students and postdoctoral fellows who are in the initial stages of their career in this field. The participants represented the field quite well, in subjects ranging from the algebraic aspects of the representation theory of infinite–dimensional algebras, the combinatorial aspects of the crystal base theory and the path model, the geometric aspects of quiver varieties and the mathematical physics aspects of the Bethe Ansatz. Towards the end of the conference a good picture emerged of the development and the interplay between the different aspects of the subject.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5064/

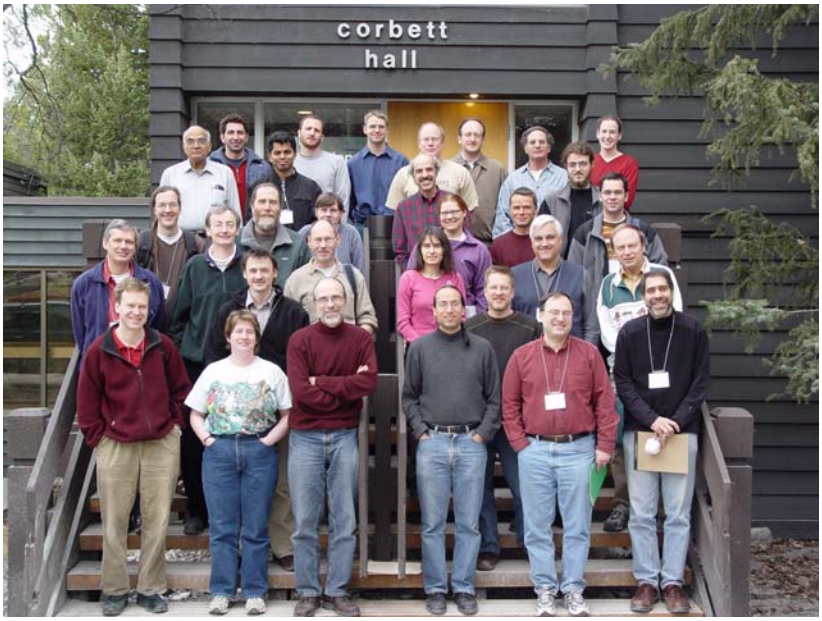
Participants:

Bakalov, Bojko (North Carolina State University)
Berg, Jennifer (UC-Berkeley)
Brundan, Jonathan (University of Oregon)
Chari, Vyjayanthi (UC-Riverside)
Cliff, Gerald (University of Alberta)
Ehrig, Michael (University of Wuppertal)
Fourier, Ghislain (University of Wuppertal)
Greenstein, Jacob (University of California Riverside)
Haiman, Mark (UC-Berkeley)
Hernandez, David (École Normale Supérieure-Paris)
Kang, Seok-Jin (Seoul National University)
Kedem, Rinat (University of Illinois)
Kwon, Jae-Hoon (University of Seoul)
Littelmann, Peter (University of Wuppertal)
Loktev, Sergey (Kyoto University)
Magyar, Peter (Michigan State University)
Malkin, Anton (University of Illinois)
Misra, Kailash (North Carolina State University)
Moura, Adriano (UC-Riverside)
Mukhin, Evgeny (Indiana University-Purdue University Indianapolis)
Naito, Satoshi (University of Tsukuba)
Okado, Masato (Osaka University)
Premat, Alejandra (University of Regina)
Reshetikhin, Nicolai (UC-Berkeley)
Sagaki, Daisuke (University of Tsukuba)
Sankaran, Viswanath (UC-Davis)
Schilling, Anne (UC-Davis)
Schwer, Christoph (Universität Wuppertal)
Senesi, Prasad (UC-Riverside)
Shimozono, Mark (Virginia Tech)
Snyder, Noah (UC-Berkeley)
Stroppel, Catharina (University of Glasgow)
Tingley, Peter (UC-Berkeley)
Varagnolo, Michela (Université de Cergy-Pontoise)
Wang, Weiqiang (University of Virginia)
Webster, Benjamin (UC-Berkeley)
Yakimov, Milen (UC-Santa Barbara)
Yee, Wai Ling (University of Alberta)

Workshop in Homotopical Localization and the Calculus of Functors
April 2–7, 2005

Organizers:

Kristine Bauer (University of Calgary)
Ralph Cohen (Stanford University)
George Peschke (University of Alberta)
Hal Sadofsky (University of Oregon)



This workshop focused on two relatively recent developments in homotopy theory: homotopical localization, and the calculus of homotopy functors. Both of these subjects have witnessed vigorous activity in the past decade, each in its own right as well as in interaction. The workshop brought together the leading contributors to certain intertwined developmental streams in algebraic topology. An effort was made to promote, as of yet, the sparsely explored interrelationship between these two subjects.

The meeting broadened the awareness of the relatively young subject of calculus of functors and brought the ubiquitous homotopical localization functors in direct contact with it. The secondary goal of this workshop was to expose young researchers in the field to new and exciting problems in algebraic topology coming from the recent interaction between these two fields.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5078/

Participants:

Arlettaz, Dominique (Universite de Lausanne)
Bauer, Kristine (University of Calgary)
Casacuberta, Carles (University of Barcelona)
Chebolu, Sunil (University of Washington)
Ching, Michael (MIT)
Chorny, Boris (University of Western Ontario)
Dover, Lynn (University of Alberta)
Dror-Farjoun, Emmanuel (Hebrew University of Jerusalem)
Dwyer, William (Notre Dame University)
Goodwillie, Tom (Brown University)
Gutierrez, Javier (University of Barcelona)
Hovey, Mark (Wesleyan University)
Krause, Eva (University of Alberta)
Kudryavtseva, Elena (University of Calgary/Moscow State University)
Kuhn, Nick (University of Virginia)
Lambrechts, Pascal (Louvain-la-Neuve)
Mauer-Oats, Andrew (Northwestern University)
McCarthy, Randy (University of Illinois at Urbana-Champaign)
Munson, Brian (Stanford University)
Nicas, Andrew (McMaster University)
Nikolaev, Igor (University of Calgary)
Palmieri, John (University of Washington)
Peschke, George (University of Alberta)
Prince, Tom (University of Alberta)
Ravenel, Douglas (University of Rochester)
Sadofsky, Hal (University of Oregon)
Scull, Laura (University of British Columbia)
Sinha, Dev (University of Oregon)
Stanley, Don (University of Regina)
Varadarajan, Kalathoor (University of Calgary)
Volic, Ismar (University of Virginia)
von Bergmann, Jens (University of Calgary)
Weiss, Michael (University of Aberdeen)
Zvengrowski, Peter (University of Calgary)

Complex Data Structures
April 9-14, 2005

Organizers:

James Berger (Stat and Applied Math Institute)
Nancy Reid (University of Toronto)
James Stafford (University of Toronto)
Mary Thompson (University of Waterloo)

Leaders in Computer Experiments, Data Mining, Genomics and Survey Methods met at BIRS and each organized a day of activity in their respective fields. An additional day was devoted to three pilot projects that have inaugural workshops later this year in the areas of Biomedicine, Forestry and Marine Ecology. Research presentations were incredibly varied and included topics that concerned pharmacophore identification, complex HIV proteomic data structures, communications security, studies of complex traits, social behaviour, forest fires, high throughput genomics, tracking of leatherback turtles, turbulence, and so on. Underlying such a diverse set of topics was a genuine common interest in complex data, regardless of its origin. The common interest bonded participants in their vision of what National Program on Complex Data Structures (NPCDS) can bring to the statistical sciences community in Canada. Concretely, the establishment of interdisciplinary projects with quantitative leadership was viewed as a vehicle that gives our community a greater voice in the research agenda's of other disciplines. These projects have the potential to create a culture in the discipline where training takes place in intensely interdisciplinary environments ensuring young researchers become effective collaborators in the long run.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5504/

Participants:

Berger, James (Stat and Applied Math Institute)
Bingham, Derek (Simon Fraser University)
Braun, John (University of Western Ontario)
Bryan, Jennifer (University of British Columbia)
Bull, Shelley (University of Toronto)
Chipman, Hugh (Acadia University)
Ciampi, Antonio (McGill University)
Cook, Richard (University of Waterloo)
Field, Chris (Dalhousie University)
Greenwood, Celia (University of Toronto)
Gustafson, Paul (University of British Columbia)
Hatzakis, George (McGill University)
Kourti, Theodora (McMaster University)
Kovacevic, Milorad (Statistics Canada)
Kustra, Rafal (University of Toronto)
Léger, Christian (Université de Montreal)
Linkletter, Crystal (Simon Fraser University)
Loeppky, Jason (University of British Columbia)
Lu, Irene (York University)
Mills, Shirley (Carleton University)
Mills Flemming, Joanna (Dalhousie University)
Nadon, Robert (McGill University)
Norminton, Ted (Carleton University)
Pantoja Galicia, Norberto (University of Waterloo)
Qian, Zhiguang (Georgia Tech)
Ramsay, Jim (McGill University)
Ranjan, Pritam (Simon Fraser University)
Reid, Nancy (University of Toronto)
Routledge, Rick (Simon Fraser University)
Song, Peter (University of Waterloo)
Stafford, James (University of Toronto)
Susko, Ed (Dalhousie University)
Sutradhar, Brajendra (Memorial University of Newfoundland)
Thomas, Roland (Carleton University)
Wang, Steven (York University)
Wang, Liqun (University of Manitoba)
Welch, Will (University of British Columbia)
Young, Stan (National Institute of Statistical Sciences)
Zanke, Brent (Ontario Institute for Cancer Research)
Zhu, Mu (University of Waterloo)

Numerical Relativity
April 16–21, 2005

Organizers:

Douglas Arnold (University of Minnesota)
Matthew Choptuik (University of British Columbia)
Randy LeVeque (University of Washington)
Eitan Tadmor (University of Maryland)

Many groups around the world have been working intensively on numerical relativity for the past several years, and yet progress has been slow due to a variety of numerical and analytical difficulties. Numerical analysts and other applied mathematicians share expertise gained in other fields and find new problems to tackle, which may lead to the development of new mathematical and computational techniques. There is a steep learning curve that is an impediment to getting started in this field and it is essential that mathematicians have an opportunity to work directly with knowledgeable physicists who have expertise in general relativity and first-hand experience with the mathematical and numerical difficulties encountered. Conversely, applied mathematicians collectively have a broad knowledge of techniques that have been developed in other computational sciences and that may be applicable in numerical relativity. The BIRS workshop provided an opportunity for physicists and mathematicians interested in numerical relativity to come together in an intimate atmosphere and share their expertise.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5087/

Participants:

Aichelburg, Peter C. (University of Vienna)
Alekseenko, Alexander (California State University, Northridge)
Andersson, Lars (University of Miami)
Arnold, Douglas (University of Minnesota)
Bardeen, James (University of Washington)
Bartnik, Robert (Monash University)
Baumgarte, Thomas (Bowdoin College)
Buchman, Luisa (Jet Propulsion Laboratory)
Calabrese, Gioel (University of Southampton)
Choptuik, Matthew (University of British Columbia)
Christiansen, Snorre H. (CMA/ University of Oslo)
Falk, Rick (Rutgers University)
Frauendiener, Joerg (University of Tuebingen)
Friedrich, Helmut (Albert Einstein Institute)
Garfinkle, David (Oakland University)
Goodman, Jonathan (New York University)
Gundlach, Carsten (University of Southampton)
Hawke, Ian (University of Southampton)
Hiptmair, Ralf (Swiss Federal Institute of Technology-Zuerich)
Hirschmann, Eric (Brigham Young University)
Holst, Michael (UC-San Diego)
Keel, Markus (University of Minnesota)
Kidder, Larry (Cornell University)
Kreiss, Heinz (Royal Institute of Technology)
Laguna, Pablo (Penn State University)
LeVeque, Randy (University of Washington)
Pollney, Denis (Albert Einstein Institute)
Pretorius, Frans (University of Alberta)
Reula, Oscar (University of Cordoba)
Rossmanith, James (University of Michigan)
Sarbach, Olivier (California Institute of Technology)
Shoemaker, Deirdre (Penn State University)
Smereka, Peter (University of Michigan)
Tadmor, Eitan (University of Maryland)
Tarfulea, Nicolae (Purdue University Calumet)
Tiglio, Manuel (Louisana State University)
Winicour, Jeffrey (University of Pittsburgh)
Winther, Ragnar (University of Oslo)

Applications of torsors to Galois cohomology and Lie theory
April 23–28, 2005

Organizers:

Vladimir Chernousov (University of Alberta)
David Harari (Ecole Normale Superieure)
Shrawan Kumar (UNC-Chapel Hill)
Arturo Pianzola (University of Alberta)

The idea of building mathematical structures out of local data has been a cornerstone of both modern Mathematics and Physics. Manifolds, distributions, simplicial complexes, vector bundles, and homogeneous spaces attest to this fact. The mathematical tools that measures the obstruction preventing us from gluing local data in a compatible way are the various cohomology theories.

In the middle of the last century the theory of algebraic varieties was establishing itself as a invaluable tool that allowed “geometric methods" to be applied to arithmetical questions. But already A. Weil had explicitly singled out that one of the most powerful classical tools, namely the construction of the quotient of a manifold by the action of a Lie group (homogeneous spaces), had no successful analogue for algebraic groups acting on varieties. The answer to this riddle came from the work of Serre and of Grothendieck. The resulting theory of principal homogeneous spaces (Torsors for short), hinges around endowing schemes with the étale topology, and using various theories of “descent" to produce a coherent cohomology theory to go with it.

Exploring the connections between these two aspects of torsors: The algebraic Geometry on one hand, and the infinite dimensional Lie theory on the other, was one of the purposes of the meeting.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5030/

Participants:

Bayer-Fluckiger, Eva (Ecole Polytechnique Federale de Lausanne)
Berhuy, Gregory (University of Nottingham)
Berman, Stephan (University of Saskatchewan)
Cai, Shuang (University of California, Los Angeles)
Chernousov, Vladimir (University of Alberta)
Colliot-Thélène, Jean-Louis (Université Paris-Sud)
Cunningham, Clifton (University of Calgary)
Favi, Giordano (University of Basel)
Garibaldi, Skip (Emory University)
Gille, Philippe (Université Paris XI)
Gille, Stefan (ETH-Zuerich)
Harari, David (Ecole Normale Superieure)
Jardine, Rick (University of Western Ontario)
Karpenko, Nikita (Université Paris 6)
Knus, Max (ETH Zurich)
Krashen, Daniel (Yale University)
Kumar, Shrawan (UNC-Chapel Hill)
Kunyavskii, Boris (Bar-Ilan University)
Mathieu, Olivier (University of Lyon)
Merkurjev, Alexander (UCLA)
Minac, Jan (University of Western Ontario)
Neher, Erhard (University of Ottawa)
Panin, Ivan (Steklov Mathematical Institute, St. Petersburg)
Parimala, Raman (Tata Institute)
Peyre, Emmanuel (Universite Joseph-Fourier Grenoble I)
Pianzola, Arturo (University of Alberta)
Queguiner-Mathieu, Anne (Université Paris 13)
Raghunathan, Madabusi S. (Tata Institute of Fundamental Research)
Raskind, Wayne (University of Southern California)
Reichstein, Zinovy (University of British Columbia)
Remy, Bertrand (University of Lyon)
Retakh, Alexander (MIT)
Saltman, David J (University of Texas)
Scheiderer, Claus (Universität Konstanz)
Serre, Jean-Pierre (College de France)
Sujatha, R. (Tata Institute)
Szamuely, Tamas (Renyi Institute)
Tignol, Jean-Pierre (Université catholique de Louvain)
Totaro, Burt (Cambridge)
Vishik, Alexander (Institute for Information Transmission Problems, R.A.S.)

Micro- and Nano-fluidic systems Descriptions
April 30–May 5, 2005

Organizers:

Jed Harrison (University of Alberta)
Klavs Jensen (Massachusetts Institute of Technology)
Juan Santiago (Stanford University)

Microfluidics provides a technology for delivering genetic analyses, clinical diagnostics and drug discoveries in advantageous ways. The discipline was initiated in about 1989, and for some time the design of these devices, and interpretation of their performance was almost entirely empirically based. Over the past five years, efforts to develop some theoretical underpinning for the unique characteristics of flow in microfluidic chips have appeared. For example, there has been some success in designing flow channel intersections, electrokinetic control strategies, corners in serpentine flow paths (used to increase path length), and more efficient fluid mixing elements. However, the application of traditional transport and field theory (e.g. fluid mechanics, electrohydrodynamics, convective-diffusion dynamics) concepts to both pressure and electrokinetically driven microfluidic systems remains disjointed, and many questions remain open. Further, there are many fascinating observations of unusual flow behaviour that experimentalists have simply not explored, largely because no framework exists with which to interpret and understand their results. Recent experimental forays into the realm of 50-150 nm scale flow channels have produced results that are further at odds with intuitive and simple classical understanding of transport and field theory. It was the need to understand these discrepancies, in order to design around the challenges they raise, or to exploit them for novel devices, the driving force for organizing this workshop.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5044/

Participants:

Chiu, Daniel (University of Washington)
Cummings, Eric (Sandia National Laboratories)
Green, Nicolas (University of Southampton)
Harrison, Jed (University of Alberta)
Hoburg, James (Carnegie Mellon University)
Santiago, Juan (Stanford University)
Slater, Gary W. (University of Ottawa)
Tanaka, Yuki (University of Tokyo)

Aggregation and disaggregation: characterization and identification of collective demand
May 7–12, 2005

Organizers:

Pierre Andre Chiappori (University of Chicago) **Ivar Ekeland** (Pacific Institute for the Mathematical Sciences)

Aggregation, considered as a mapping from the individual demand functions to the collective demand function, is a very old topic in economic theory. The basic problem here is that, unless very specific (and mathematically interesting) conditions are met, the collective demand function will not derive from a "collective utility function"; this fact is at the core of many so-called paradoxes and the Arrow impossibility theorem.

This workshop was part of projected series entitled "mathematical structures in economic theory and econometrics", the aim of which is to foster interchanges between mathematicians, economists and econometricians on subjects of common interest.

The time was ripe for improving the theoretical models and the associated econometrics. There are basically two distinct problems: finding whether complete identification is at all possible, and devising appropriate identification methods. The first problem is mathematical; typically, its solution will require investigating systems of nonlinear PDEs, and proving uniqueness results. The second one is statistical, and will require introducing appropriate distributions factors. Both are actively pursued, and the workshop came in quite timely.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5053/

Participants:

Basaluzzo, Gabriel (University of Pennsylvania)
Bayramoglu, Basak (PSE-Ecole Nationale des Ponts et Chaussees and EUREQua)
Carlier, Guillaume (Universite Paris Dauphine)
Celik, Gorkem (University of British Columbia)
Chiappori, Pierre Andre (University of Chicago)
Ekeland, Ivar (PIMS)
Escobar, Juan (Stanford University)
Grandmont, Jean-Michel (University of Paris)
Guesnerie, Roger (College de France (Paris))
Heckman, Jim (University of Chicago)
Hildenbrand, Werner (University of Bonn)
Horst, Ulrich (University of British Columbia)
Huang, Haifang (University of British Columbia)
Jacques, Jean-François (University of Paris-Dauphine)
Jara-Moroni, Pedro (University of Chileé Paris-Jourdan Sciences Economiques)
Jerison, Michael (State University of New York- Albany)
Jofre, Alejandro (CMM, University of Chile)
Kneip, Alois (University of Mainz)
Lazrak, Ali (University of British Columbia)
Matzkin, Rosa (Northwestern University)
McCann, Robert (University of Toronto)
Miravete, Eugenio J. (University of Pennsylvania)
Moreno, Santiago (University of British Columbia)
Nakamura, Alice (University of Alberta)
Nesheim, Lars (University College London)
Peters, Mike (University of British Columbia)
Quah, John (Oxford University)
Saari, Donald (UC-Irvine)
Shannon, Chris (UC-Berkeley)
Shneyerov, Art (University of British Columbia)
Trokhimtchouk, Maxim (UC-Berkeley)
Wets, Roger (UC-Davis)
Zame, William (UC-Los Angeles)
Zerom, Dawit (University of Alberta)

Densest Packings of Spheres
May 14–19, 2005

Organizers:

Karoly Bezdek (University of Calgary)
Henry Cohn (Microsoft Research)
Charles Radin (University of Texas, Austin)

The objective of this workshop was to bring together those researchers currently working on the four related topics of the proposal, researchers who do not usually participate in common conferences. The related objective was to bring fresh insight on a number of outstanding open problems because of this confluence of research topics, for instance those open problems mentioned in the proposal. Perhaps at an even deeper level, we note that a common element in much of the research topics of the proposal is the symmetry of the optimal packings. These symmetries have been appearing in unexpected ways and we hope to gain a deeper understanding of the role of symmetry in these geometric optimization problems.

Some important recent work was being done by young researchers, and the workshop involved the next generation of researchers significantly in this workshop, including both postdocs and PhD students.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5022/

Participants:

Ball, Keith (University College London)
Betke, Ulrich (Universität Siegen)
Bezdek, Karoly (University of Calgary)
Bezdek, Andras (Auburn University)
Bowen, Lewis (University of Indiana, Bloomington)
Böröczky, Károly (Eötvös Loránd University)
Cohn, Henry (Microsoft Research)
Connelly, Robert (Cornell University)
Csikós, Balázs (Eötvös Loránd University, Budapest)
Elkies, Noam (Harvard University)
Fejes Toth, Gabor (Alfréd Rényi Institute of Mathematics)
Ferguson, Samuel (National Security Agency)
Fodor, Ferenc (University of Szeged)
Hales, Thomas C. (University of Pittsburgh)
Hausel, Tamas (University of Texas at Austin)
Henk, Martin (University of Magdeburg)
Heppes, Aladar (Renyi Institute)
Kellerhals, Ruth (University of Fribourg)
Kendall, Wilfrid (University of Warwick)
Kiss, Gyorgy (Eotvos University)
Kumar, Abhinav (Microsoft Research)
Kuperberg, Wlodzimierz (Auburn University)
Lagarias, Jeffrey (University of Michigan)
Langi, Zsolt (University of Calgary, Centre of Computational & Discrete Geometry)
Lyons, Russell (Indiana University)
McLaughlin, Sean (New York University)
Middleton, Ivan (University of Michigan)
Musin, Oleg R. (Moscow State University)
Naszódi, Marton (University of Calgary)
Nebe, Gabriele (University of Aachen)
Papez, Peter (University of Calgary)
Penrose, Mathew (University of Bath)
Pfender, Florian (Technische Universität Berlin)
Radin, Charles (University of Texas, Austin)
Schuermann, Achill (University of Magdeburg)
Sullivan, John (TU Berlin)
Torquato, Salvatore (Princeton University)
Vallentin, Frank (Centrum voor Wiskunde en Informatica)
Verger-Gaugry, Jean-Louis (CNRS - Universite de Grenoble I)
Winkler, Peter (Dartmouth College)

Moment Maps in Various Geometries
May 21–26, 2005

Organizers:

Tara Holm (University of California, Berkeley)
Lisa Jeffrey (University of Toronto)
Yael Karshon (University of Toronto)
Eugene Lerman (University of Illinois Urbana-Champaign)
Eckhard Meinrenken (University of Toronto)

Symplectic geometry was invented by Hamilton in the early nineteenth century, as a mathematical framework for both classical mechanics and geometrical optics. Physical states in both settings are described by points in an appropriate phase space (the space of coordinates and momenta). Hamilton's equations associate to any energy function ("Hamiltonian") on the phase space a dynamical system. Hamilton realized that his equations are invariant under a very large group of symmetries, called canonical transformations or, in modern terminology, symplectomorphisms.

In the past thirty years, tremendous progress has been made in the study of moment maps and related areas: symplectic quotients, geometric quantization, localization phenomena, and toric varieties. This has had applications to the study of moduli spaces, representation theory, special metrics, and symplectic topology. In recent years, moment maps have been generalized in many different directions and have led to advances in geometries related to symplectic geometry. While some headway has been made in understanding moment maps in these fields, there remain many open questions. One of the goals of this workshop was bring together experts from these fields to explore phenomena that are well understood in symplectic geometry but are not as well understood in these new settings, and to seek potential applications of this new direction of research. Thus generating a fruitful exchange of ideas, which enabled us to formulate and discuss interesting open problems.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5072/

Participants:

Abreu, Miguel (Instituto Superior Técnico, Lisboa)
Alekseev, Anton (University of Geneva)
Apostolov, Vestislav (Université du Québec à Montréal)
Bielawski, Roger (University of Glasgow)
Boyer, Charles (University of New Mexico)
Burns, Daniel (University of Michigan)
Bursztyn, Henrique (University of Toronto)
Chiang, River Meng-Jung (National Cheng Kung University)
Daskalopolous, Georgios (Brown University)
Fernandes, Rui Loja (Instituto Superior Tecnico)
Gauduchon, Paul (Ecole Polytechnique)
Guillemin, Victor (MIT)
Harada, Megumi (McMaster University)
Hausel, Tamas (University of Texas-Austin)
Henriques, Andre (MIT)
Holm, Tara (UC-Berkeley)
Hwang, Andrew (College of Holy Cross)
Jeffrey, Lisa (University of Toronto)
Karshon, Yael (University of Toronto)
Kessler, Liat (Courant Institute, NYU)
Kitchloo, Nitu (UC-San Diego)
Knutson, Allen (UC-Berkeley)
Konno, Hiroshi (University of Tokyo)
Landweber, Greg (University of Oregon)
Lerman, Eugene (UIUC)
Mare, Augustin-Liviu (University of Regina)
Martens, Johan (Columbia University)
Maschler, Gideon (University of Toronto)
Meinrenken, Eckhard (University of Toronto)
Pflaum, Markus (Johann Wolfgang Goethe-Universität)
Proudfoot, Nicholas (Columbia University)
Sjamaar, Reyer (Cornell University)
Sniatycki, Jedrzej (University of Calgary)
Sternberg, Shlomo (Harvard University)
Tang, Xiang (UC-Davis)
Tolman, Susan (UIUC)
Watts, Jordan (University of Calgary)
Weitsman, Jonathan (UC-Santa Cruz)
Wilkin, Graeme (Brown University)
Wu, Siye (University of Colorado Boulder)
Zara, Catalin (Penn State Altoona)

Critical Scaling for Polymers and Percolation
May 28–June 2, 2005

Organizers:

David Brydges (University of British Columbia)
Jennifer Chayes (Microsoft Research)
Gordon Slade (University of British Columbia)

Equilibrium statistical mechanics is the mathematical framework created by Gibbs for predicting macroscopic properties of matter from a microscopic description. Within this framework thermodynamic functions of state such as temperature and entropy are defined in such a way as to satisfy the laws of thermodynamics. In principle the formalism determines the model specific relation called the equation of state. The first example of such a prediction is the famous ideal gas law P = (n/V)RT relating pressure P to the number of atoms/ volume and temperature T. This is the equation of state for an assembly of non-interacting particles. This equation is notable for having no singularities: in the physical domain T > 0 the pressure is a smooth function of temperature. However interacting systems will not in general relate thermodynamic variables in a smooth way and therefore the equation of state has singularities which reflect phase transitions. For example the density of water changes discontinuously as a function of temperature at the boiling point. In practice the determination of the complete equation of state is not realistic for systems with interactions, but the nature of the singularities, the exponents of power law divergences at these singularities, are more accessible. Thus these singularities have been the focus of research.

In this meeting experts with experience in the subjects, as well as related areas such as combinatorics, exact solutions and Monte Carlo algorithms were brought together at BIRS. The methods were quite different but common goals provide the motivation to jump across cultural barriers.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5025/

Participants:

Aizenman, Michael (Princeton University)
Alvarez, Juan (University of Saskatchewan)
Angel, Omer (UBC)
Biskup, Marek (UCLA)
Bolthausen, Erwin (Universität Zürich)
Borgs, Christian (Microsoft Research)
Brydges, David (UBC)
Camia, Federico (EURANDOM)
Cardy, John (Oxford University)
Chayes, Jennifer (Microsoft Research)
Cotar, Codina (UBC)
den Hollander, Frank (University of Leiden/ EURANDOM)
Duplantier, Bertrand (Saclay)
Goodman, Jesse (UBC)
Hara, Takashi (Kyushu University)
Holmes, Mark (UBC)
Holroyd, Alexander (UBC)
Imbrie, John (University of Virginia)
Janse van Rensburg, Buks (York University)
Jarai, Antal (Carleton University)
Kennedy, Tom (University of Arizona)
Kozdron, Michael (University of Regina)
Lawler, Greg (Cornell University)
Madras, Neal (York University)
Newman, Chuck (Courant-New York University)
Peres, Yuval (UC-Berkeley)
Rohde, Steffen (University of Washington)
Roitershtein, Alexander (UBC)
Rolles, Silke (Eindhoven University of Technology)
Saint-Aubin, Yvan (University of Montreal)
Sakai, Akira (Eindhoven University of Technology)
Sheffield, Scott (UC-Berkeley)
Slade, Gordon (UBC)
Soteros, Chris (University of Saskatchewan)
Szafron, Michael (University of Saskatchewan)
van der Hofstad, Remco (Eindhoven University of Technology)
Virag, Balint (University of Toronto)
Werner, Wendelin (University of Paris Sud, Orsay)
Whittington, Stuart (University of Toronto)
Wilson, David (Microsoft Research)

Mathematical Issues in Molecular Dynamics
June 4–9, 2005

Organizers:

Robert Skeel (Purdue University)

Paul Tupper (McGill University)

This workshop brought together molecular dynamics (MD) specialists, numerical analysts and other applied mathematicians to study the mathematical problems in molecular dynamics. We hoped that with this interaction progress be made on outstanding theoretical problems, new problems in MD be brought to the attention of mathematicians and insight be gained into how to better design algorithms for MD. The workshop focused on several topics: "Why Does MD work?", Computational Artifacts, Convergence of MD/MC and Multiscale Simulation.

Molecular Dynamics is an extremely important area in Physics, Chemistry, and Biochemistry, as a glance recent publications in these fields will show. Despite MD being around for a few decades, there is almost no mathematically rigorous justification of the practice. However, we believe that many of the pieces are ready to be put into place.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5025/

Participants:

Alvarez, Juan (University of Saskatchewan)
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Bond, Stephen (University of Illinois, Urbana-Champaign)
Bryce, Robert (University of Alberta)
Chipot, Christophe (Université Henri Poincaré/ CNRS)
Cottrell, David (McGill University)
Darve, Eric (Stanford University)
Hayes, Wayne (UC-Irvine)
Hummer, Gerhard (National Institutes of Health)
Izaguirre, Jesus (University of Notre Dame)
Karttunen, Mikko (Helsinki University of Technology)
Leimkuhler, Ben (University of Leceister)
Lin, Florence (University of Southern California)
Luchko, Tyler (University of Alberta)
Marcia, Roummel (Wisconsin University)
Mattingly, Jonathan (Duke University)
Meerbach, Eike (Free University Berlin)
Neal, Radford (University of Toronto)
Negrut, Dan (Argonne National Laboratory)
Newman, William (UCLA)
Pokern, Yvo (Warwick University)
Posch, Harald (University of Vienna)
Reich, Sebastian (Imperial College)
Roland, Christopher (NCSU)
Shardlow, Tony (University of Manchester)
Skeel, Robert (Purdue University)
Straub, John (Boston University)
Stuart, Andrew (Warwick University)
Sweet, Chris (Leicester)
Tretyakov, Michael (University of Leceister)
Tuckerman, Mark (New York University)
Tupper, Paul (McGill University)

Geometric and Asymptotic Methods in Group Theory
June 11–16, 2005

Organizers:

Rostislav Grigorchuk (Texas A&M University)
Alexander Olshanskiy (Vanderbilt University)
Akbar Rhemtulla (University of Alberta)
Mark Sapir (Vanderbilt University)
Daniel Wise (McGill University)

The goal of the conference was to bring together specialists in geometric, probabilistic and asymptotic methods in group theory. Special attention was paid to the following topics: (1) Amenability and randomness in groups, (2) Actions on rooted trees, growth and self-similarity, (3) Groups, boundaries and geometries, and (4) Lattices in Lie groups.

Many informal discussions lead to creating new ideas of collaboration between specialists in different areas of group theory. In particular, it may be possible to make groups of intermediate growth and torsion groups act on cubings using the end structure of their Schreir graphs; several properties of 1-relator groups which are believed to be generic may be connected to important properties of random walks on lattices, etc.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5011/

Participants:

Abert, Miklos (University of Chicago)
Alperin, Roger (San Jose State University)
Behrstock, Jason (Columbia University)
Bondarenko, Ievgen (Texas A&M University)
Cannon, Jim (Brigham Young University)
Chatterji, Indira (Columbia University)
Glasner, Yair (University of Illinois at Chicago)
Grigorchuk, Rostislav (Texas A&M University)
Haglund, Frederic (University of Paris-Sud)
Hruska, Chris (University of Chicago)
Hsu, Tim (San Jose State University)
Kaimanovich, Vadim (International University Bremen)
Kassabov, Martin (Cornell University)
Kharlampovich, Olga (McGill University)
Kropholler, Peter (University of Glasgow)
Lauer, Joe (McGill University)
Mann, Avinoam (Hebrew University, Jerusalem)
Miasnikov, Alexei (McGill University)
Morris, Dave Witte (University of Lethbridge)
Muchnik, Roman (University of Chicago)
Niblo, Graham (University of Southampton)
Nica, Bogdan (Vanderbilt University)
Pride, Steve (University of Glasgow)
Rhemtulla, Akbar (University of Alberta)
Sageev, Michah (Technion)
Sapir, Mark (Vanderbilt University)
Savchuk, Dmytro (TexasA&M)
Segal, Dan (Oxford University)
Shpilrain, Vladimir (City College of New York)
Smirnova-Nagnibeda, Tatiana (University of Geneva)
Steinberg, Benjamin (Carleton University)
Sunik, Zoran (Texas A&M University)
Virag, Balint (University of Toronto)
Wise, Daniel (McGill University)
Zuk, Andrzej (Institut de Mathematiques)

Combinatorial Game Theory Workshop
June 18–23, 2005

Organizers:

Elwyn Berlekamp (University of California-Berkeley)
Martin Mueller (University of Alberta)
Richard Nowakowski (Dalhousie University)
David Wolfe (Gustavus Adolphus College)

This BIRS workshops brought together the two camps, mathematicians working in combinatorial game theory and computer scientists interested in algorithmics and artificial intelligence, i.e. the heuristics, structures and procedures needed to approximate or find best play. Essentially, the former worked from the end of the game and the latter worked from the beginning. The field, and the number of practitioners in it, has increased recently.

There has been loose connection between local groups working on old and new areas. The University of Alberta GAMES group does research into artificial intelligence using games as experimental test beds. The games used include combinatorial games (such as Go and Amazons), classical board games (chess, checkers, Othello), cards games (poker), and commercial games. Game-related research includes new high-performance search algorithms and machine-learning techniques. A group lead by Aaron Siegel has developed a new software tool, CGSuite, which is a versatile, graphical Java program for computing and manipulating game positions and their values. This tool puts the analysis of many positions and games within the realm of the ordinary practitioner.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5048/

Participants:

Albert, Michael (University of Otago)
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Demaine, Erik (MIT)
Demaine, Martin (MIT)
Elkies, Noam (Harvard University)
Enzenberger, Markus (University of Alberta)
Fink, Alex (University of Calgary)
Fraenkel, Aviezri (Weizmann Institute of Science)
Fraser, William (Data Mining International Inc.)
Friedman, Eric (Cornell University)
Fristedt, Bert (University of Minnesota, Twin Cities)
Grossman, JP (Configuresoft, Inc.)
Guy, Richard (University of Calgary)
Hayward, Ryan (University of Alberta)
Hearn, Robert (Massachusetts Institute of Technology)
Landsberg, Adam (Claremont McKenna, Pitzer/ Scripps Colleges)
Lim, Yew Jin (National University of Singapore)
Mueller, Martin (University of Alberta)
Nakamura, Teigo (Kyushu Institure of Technology)
Nivasch, Gabriel (Tel-Aviv University)
Nowakowski, Richard (Dalhousie University)
Ottaway, Paul (Dalhousie University)
Pearson, Mark (UC-Berkeley)
Plambeck, Thane (Palo Alto, California)
Siegel, Aaron (UC-Berkeley)
Spight, Bill (Saybrook Graduate School)
Stewart, Fraser (University of St. Andrews)
van Rijswijck, Jack (University of Alberta)
Weimerskirch, Mike (University of Minnesota)
Wilson, David (The University of Wisconsin - Madison)
Wolf, Thomas (Brock University)
Wolfe, David (Gustavus Adolphus College)
Yang, Boting (University of Regina)

New Directions in PDE 2005
July 2–7, 2005

Organizers:

Stephen Gustafson (University of British Columbia)

This workshop focused on several important streams of current research in partial differential equations, with two principal goals in mind. One was to introduce young researchers to new developments and future directions of research in PDE. The other was to foster connections and collaboration between mathematicians in Canada and the U.S., with those in Latin America. To the first end, we especially invited participation by graduate students and postdocs. Experts gave expository lectures, and lead informal sessions (including problem-solving, for example) in their fields. To the second end, we expected and encourage participation by many researchers and students from throughout Latin America. Areas of focus included (1) the calculus of variations and nonlinear elliptic problems; (2) geometric PDE and geometric analysis; (3) nonlinear evolution equations; and (4) inverse problems.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5506/

Participants:

Biryuk, Andrei (McMaster University)
Cano, Alfredo (UNAM)
Fraser, Ailana (UBC)
Garcia-Huidobro, Marta (Pontificia Universidad Catolica de Chile)
Ghoussoub, Nassif (UBC)
Guan, Meijiao (UBC)
Gustafson, Stephen (UBC)
Hernandez, Eric (UNAM)
Ibrahim, Slim (McMaster University)
Khouider, Boualem (University of Victoria)
Manasevich, Raul (University of Chile)
Moameni, Abbas (UBC)
Niksirat, Mohammad (SFU)
Panferov, Vladislav (McMaster University)
Rademacher, Jens (UBC)
Spitzer, Wolfgang (UBC)
Sun, Pengtao (SFU)
Takei, Ryo (SFU)
Ting, Fridolin (Lakehead University)
Torres, Francisco (UNAM)
Tzou, Leo (University of Washington)
Ubilla, Pedro (Universidad de Santiago de Chile)
Uhlmann, Gunther (University of Washington)
Yan, Yu (UBC)
Zhang, Ping (SFU)

Rigidity, Dynamics, and Group Actions
July 9–14, 2005

Organizers:

David Fisher (Lehman College-CUNY)
Elon Lindenstrauss (Princeton University)
Dave Witte Morris (University of Lethbridge)
Ralf Spatzier (University of Michigan)

Rigidity theory has its roots in classical theorems of Selberg, Weil, Mostow, Margulis and Furstenberg. It extends into diverse areas such as complex and differential geometry, group theory and representation theory, ergodic theory, dynamics and group actions. Our conference concentrated on the rapid recent progress in these areas. The study of "large" groups (such as lattices in semisimple groups or higher rank abelian groups) and their actions was the focal point of the conference, with particular attention given to four closely related topics: local and global rigidity of actions, low-dimensional actions of large groups, orbit-equivalence rigidity, and invariant measures for actions on homogeneous spaces.

We had many exciting talks on these and other topics on large groups. Exciting recent progress more generally in dynamics, geometry and geometric group theory was also discussed and presented in talks. Many new connections between dynamics of group actions and other areas, including number theory, geometry, and operator algebras, were discussed.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5029/

Participants:

Bader, Uri (University of Chicago)
Breuillard, Emmanuel (Institut des Hautes Etudes Scientifiques)
Cantat, Serge (Université de Rennes)
Chatterjee, Pralay (Rice University)
Dani, S.G. (Tata Institute of Fundamental Research)
Day, Matthew (University of Chicago)
Eskin, Alex (University of Chicago)
Farb, Benson (University of Chicago)
Feres, Renato (Washington University)
Fisher, David (Lehman College-CUNY)
Franks, John (Northwestern University)
Furman, Alex (University of Illinois Chicago)
Furstenberg, Hillel (Hebrew University)
Gelander, Tsachik (Yale University)
Gorodnik, Alex (California Institute of Technology)
Handel, Michael (Lehman College)
Hitchman, T.J. (Rice University)
Kleinbock, Dmitry (Brandeis University)
Klingler, Bruno (University of Chicago)
Kloeckner, Benoît (École Normale Supérieure de Lyon)
Ledrappier, Francois (University of Notre Dame)
Lindenstrauss, Elon (Princeton University)
Margulis, Gregory (Yale University)
Melnick, Karin (University of Chicago)
Morris, Dave Witte (University of Lethbridge)
Mozes, Shahar (Hebrew University)
Oh, Hee (California Institute of Technology)
Peterson, Jesse (UC-Berkeley)
Polterovich, Leonid (Tel Aviv University)
Popa, Sorin (UCLA)
Raghunathan, Madabusi S. (Tata Institute of Fundamental Research)
Ratner, Marina (UC-Berkeley)
Sarig, Omri (Penn State University)
Schmidt, Ben (University of Michigan)
Shah, Nimish (Tata Institute of Fundamental Research, Mumbai, India)
Shalom, Yehuda (Tel Aviv University)
Spatzier, Ralf (University of Michigan)
Stolovitch, Laurent (Universite Paul Sabatier)
Tomanov, George (Université Claude-Bernard, Lyon)
Weiss, Barak (Ben Gurion University of the Negev)
Zimmer, Robert (Brown University)

Mathematical Biology of the Cell: Cytoskeleton and Motility
July 16–21, 2005

Organizers:

Eric Cytrynbaum (University of British Columbia)
Paul Janmey (University of Pennsylvania)
Leah Keshet (University of British Columbia)
Alex Mogilner (University of California-Davis)

Highlight of the sessions was the juxtaposition of the biological experimental observations with the theory that aims to elucidate underlying mechanisms. By bringing together the people who carry out experiments with those who work on the theoretical basis of the field, we hoped to facilitate new scientific developments that intersect both.

Participants included internationally recognized leaders in cell biology, known to be open minded and interested in exchange of theoretical ideas, and those known for their theoretical work. Our sessions aimed at showing how the two approaches complement one another.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5004/

Participants:

Alberts, Jonathan B. (Friday Harbor Labs)
Ananthakrishnan, Revathi (UC-Davis)
Beil, Michael (University Ulm)
Carlsson, Anders (Washington University)
Cytrynbaum, Eric (University of British Columbia)
Dawes, Adriana (University of British Columbia)
Dickinson, Richard (University of Florida)
Discher, Dennis E. (University of Pennsylvania)
Dogterom, Marileen (FOM Institute AMOLF)
Fleischer, Frank (University of Ulm)
Hill, Nicholas (University of Glasgow)
Hinz, Boris (Swiss Federal Institute of Technology)
Iglesias, Pablo (Johns Hopkins University)
Jacobson, Ken (University of North Carolina Chapel Hill)
Janmey, Paul (University of Pennsylvania)
Jilkine, Alexandra (University of British Columbia)
Julicher, Frank (Max Planck Institut für Physik)
Keshet, Leah (University of British Columbia)
Kozlov, Michael (Tel Aviv University)
Käs, Josef A. (University of Leipzig)
Lubkin, Sharon (North Carolina State University)
MacKintosh, Fred (Vrije Universiteit)
Mogilner, Alex (UC-Davis)
Munro, Ed (Friday Harbor Labs)
Odde, David (University of Minnesota)
Oliver, James (University of Nottingham)
Othmer, Hans (University of Minnesota)
Pollard, Thomas D. (Yale University)
Portet, Stephanie (University of Toronto)
Robinson, Douglas (Johns Hopkins University)
Schmidt, Volker (University of Ulm)
Scholey, Jon (UC-Davis)
Sept, David (Washington University)
Sykes, Cécile (Institut Curie)
Tuszynski, Jack (University of Alberta)
Upadhyaya, Arpita (University of Maryland)
Van Oudenaarden, Alexander (MIT)
Verkhovsky, Alexander (Swiss Federal Institute of Technology)
Weaver, Alissa (Vanderbilt University Medical Center)

Multimedia and Mathematics
July 23–28, 2005

Organizers:

Robert Gray (Stanford University)

Rabab Ward (Institute for Computing, Information and Cognitive Systems, UBC)

The diverse applications of multimedia technology affect the way we communicate, work and play. The BIRS workshop on Multimedia and Mathematics brought university and industry personnel together to share ideas about the latest advances in the different areas of multimedia and related mathematics. Forty attendees from Canada, UK, Australia and the USA comprised graduate students and faculty members from 24 universities, as well as 8 researchers from Microsoft, Apple, Hewlett-Packard, Tiz Media Foundation, and the National Science Foundation. The rich cross-fertilization brought about by this workshop provided new insights into possible solutions to the latest technical challenges.

Academics and mathematicians, as well as practitioners, engineers, and researchers working in different industries related to multimedia devices, described the approaches, advances, and constraints involved in their area of media. With a view to discovering common ground, they explored the mathematical modeling, analysis, and representation of information relevant to their respective fields.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5505/

Participants:

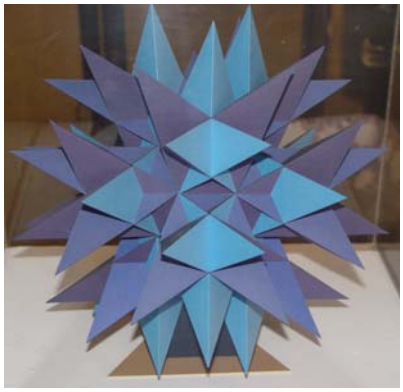
Abugharbieh, Rafeef (UBC)
Apostolopoulos, John (Hewlett-Packard Laboratories)
Basu, Sankar (National Science Foundation)
Chen, Tsuhan (Carnegie Mellon University)
Chou, Philip (Microsoft Research)
Coria Mendoza, Lino (UBC)
Deng, Li (Microsoft)
Donoho, David (Stanford)
Du, Shan (UBC)
Dumitras, Adriana (Apple Computer)
Effros, Michelle (California Institute of Technology)
Ghoussoub, Nassif (UBC)
Goyal, Vivek (MIT)
Gray, Robert (Stanford University)
Guan, Ling (Ryerson University)
Hamarneh, Ghassan (SFU)
Hammond, David (New York University)
Hemami, Sheila (Cornell University)
Hero, Alfred (University of Michigan)
Kalker, Ton (Hewlett Packard)
Kingsbury, Nick (University of Cambridge, UK)
Kundur, Deepa (Texas A&M University)
Lee, Ivan (Ryerson University)
Liang, Jie (SFU)
Liu, K. J. Ray (University of Maryland)
Mersereau, Russ (Georgia Tech)
Moura, Jose' M. F. (Carnegie Melon University)
Nasiopoulos, Panos (University of British Columbia)
O'Brien, Deirdre (Stanford University)
Orchard, Michael (Rice University)
Ostendorf, Mari (University of Washington)
Pappas, Thrasyvoulos (Northwestern University)
Pickering, Mark (University of New South Wales)
Plataniotis, Konstantinos (University of Toronto)
Pourazad, Mahsa (UBC)
Said, Amir (Hewlett-Packard Labs)
Shirani, Shahram (McMaster University)
Simoncelli, Eero (New York University)
Tzanetakis, George (University of Victotia)
von dem Knesebeck, Matthias (UBC)
Ward, Rabab (ICICS, UBC)
West, Melanie (TIZ Media Foundation)

Renaissance Banff: Mathematics, Music, Art, Culture
July 30–August 4, 2005

Organizers:

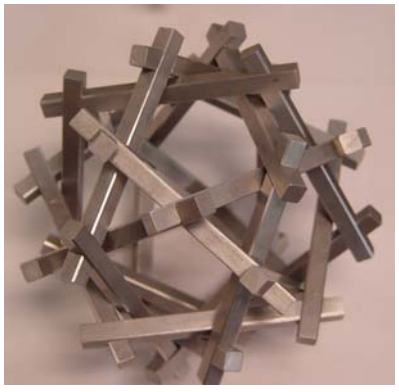
Nassif Ghoussoub (University of British Columbia)
Robert Moody (University of Victoria)
Christiane Rousseau (Universite de Montreal)
Reza Sarhangi (Towson University)

The Renaissance Banff Conference was comprised of the 8th annual conference of Bridges: Mathematical Connections in Art, Music, and Science, plus a special Coxeter Day commemorating the artistic side of the late Donald Coxeter.



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

The conference was accompanied by a refereed and edited Proceedings that contains all the talks (some 80 of them) that were presented during the conference, and a CD on which the art exhibition, as well as the papers, are fully documented.



For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5082/

Participants:

Ahrens, Sue & Richard
Ahuja, Mangho
Akleman, Ergun
Allen, Amina & Marc Pelletier
Arthur, Christopher
Ascher, Marcia & Robert
Krantz, Richard
Krawczyk, Robert (Illinois Institute of Tech)
Kuczynska, Anna
Longuet Higgins, Michael
Maddow, Ellen (The Talking Band)
Maddow- Zimet, Isaac & Paul
Maehata, Ken & Noriko
Mahan, Michael
Mandelbaum, Stephanie
Mashayekh, Hourieh
Maslanka, Kaz
Masunaga, David
Matsuura, Akihiro
Mc Burney, Susan
Mc Dermott, Robert
Melville, Sarah

Melville, Duncan
Mihala, Ioana (Cal Poly State)
Moody, Robert (University of Victoria)
Morse, Trudy (Malcolm Morse Foundation)
Myrvold, Wendy (University of Victoria)
Nutall, Diana
Palmer, Chris
Palmer, Curtis
Picket, Barbara
Rappaport, David
Richter, David A. (Western Michigan University)
Roberts, Siobhan
Robertson, Ann
Roelofs, Rinus
Rousseau, Christiane (Universite de Montreal)
Rousseau, Irene
Sadosky, Cora
Sarhangi, Reza (Towson University)
Sarhangi, Maryam (University of Maryland)
Schattschneider, Doris (Moravian College)
Senechal, Marjorie (Smith College)

Sequin, Carlo & Margareta
Sharp, John
Shea, Laura
Spencer, Stanley
Srinivasan, Vinod
Tate, Ann
Termes, Dick
Tobie, Roger
Toussaint, Godfried (McGill University)
Usnick, Virginia
Van Ballegooijen, Walt
Vorthmann, Scott
Wagon, Stan
Walter, Marion
Watt, Kate
Whitelaw, Cheryl (Southern Utah University)
Williams, Mary (Arizona State University)
Winter, Mary Jean (Michigan State University)
Zeilinski, Daylene (Bellarmine University)
Zimmerman, Jay
Zwicky, Jan (University of Victoria)

Mathematical epidemiology
August 20–25, 2005

Organizers:

Herbert Hethcote (University of Iowa)
Simon Levin (Princeton University)
Pauline van den Driessche (University of Victoria)

One barrier to effective modeling of infectious diseases and intervention policies is the lack of communication between the modelers and the policy makers. A primary objective of the workshop was to encourage communication among internationally-recognized applied mathematicians, statisticians, epidemiologists, and public health officials. To encourage this communication, each half-day started with a lecture by a well-known plenary speaker on a specific disease or an epidemiological problem. These plenary talks were followed by other talks and discussion periods about challenges and opportunities for modeling to contribute to public health policy. These could include presentations of epidemiology modeling approaches and comparisons of disease intervention strategies that might be appropriate for the United States and Canada. The workshop provided the opportunity for new projects and collaborations involving the applications of modeling approaches to problems in understanding infectious disease transmission and intervention strategies.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5003/

Participants:

Allen, Linda (Texas Tech University)
Andreasen, Viggo (Roskilde University)
Arino, Julien (University of Manitoba)
Bauch, Chris (University of Guelph)
Billings, Lora (Montclair State University)
Bowman, Christopher (National Research Council Canada)
Brauer, Fred (University of British Columbia)
Chowell, Gerardo (Los Alamos National Laboratory)
Dushoff, Jonathan (Princeton University)
Earn, David (McMaster University)
Esteva, Lourdes (UNAM)
Feng, Zhilan (Purdue University)
Galvani, Alison (Yale University)
Glasser, John (Centers for Disease Control)
Greenhalgh, David (University of Strathclyde)
Gumel, Abba (University of Manitoba)
Hartvigsen, Gregg (SUNY Geneseo)
Hethcote, Herbert (University of Iowa)
Hsieh, Ying-Hen (National Chung-Hsing University)
Levin, Simon (Princeton University)
Lloyd, Alun (North Carolina State University)
Ma, Zhien (Xi'an Jiaotong University)
Ma, Junling (McMaster University)
McCluskey, Connell (McMaster University)
Medlock, Jan (Yale University)
Morris, Martina (University of Washington)
Newman, Mark (University of Michigan)
Norman, Rachel (University of Stirling)
Pascual, Mercedes (University of Michigan)
Perelson, Alan (Los Alamos National Laboratory)
Plotkin, Joshua (Harvard Society of Fellows)
Rao, Arni SR Srinivasa (University of Guelph)
Rapatski, Brandy (Richard Stockton College of New Jersey)
Ruan, Shigui (University of Miami)
Saenz, Roberto (University of Iowa)
Turbow, David (Touro University International)
van den Driessche, Pauline (University of Victoria)
Watmough, James (University of New Brunswick)
Wu, Jianhong (York University)
Yorke, James (University of Maryland)

Topology
August 27–September 1, 2005

Organizers:

Ian Hambleton (McMaster University)
Michael Hopkins (Massachusetts Institute of Technology)
Matthias Kreck (University of Heidelberg)
Ronald Stern (University of California-Irvine)

For the past decade we have seen a vast development and flourishing of new topology subspecialties, many of which have had unexpected applications in other subjects. One result, however, has been the fragmentation of research in topology as a whole and the growing isolation of the experts in each of these flourishing topological areas from the others. This workshop brought together both the senior and junior leaders of these subspecialties to alert this broader topology community of experts to new developments in other exciting topological areas. The expectation is that the breakthroughs in one part of topology will catalyze progress in another.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5067/

Participants:

Adem, Alejandro (UBC)
Akbulut, Selman (Michigan State University)
Auroux, Denis (MIT)
Baldridge, Scott (Louisiana State University)
Bartels, Arthur (Universität Münster)
Bauer, Kristine (University of Calgary)
Boden, Hans (McMaster University)
Bridson, Martin R. (Imperial College London)
Chen, Weimin (University of Massachusetts, Amherst)
Collin, Olivier (Université du Québec à Montréal)
Dwyer, William (Notre Dame University)
Edwards, Bob (UCLA)
Grodal, Jesper (Chicago/Copenhagen)
Hambleton, Ian (McMaster University)
Kirby, Robion (UC-Berkeley)
Kleiner, Bruce (University of Michigan)
Kreck, Matthias (University of Heidelberg)
Lueck, Wolfgang (Universitat Munster)
Lurie, Jacob (Harvard University)
Mark, Thomas (University of Virginia)
Matic, Gordana (University of Georgia)
Mrowka, Tom (MIT)
Neumann, Walter (Columbia University)
Ozsvath, Peter (Columbia University)
Park, Jongil (Seoul National University)
Pedersen, Erik (SUNY Binghamton)
Ranicki, Andrew (University of Edinburgh)
Rasmussen, Jacob (Princeton University)
Reich, Holger (Universität Münster)
Ruan, Yongbin (University of Wisconsin-Madison)
Stern, Ronald (UC-Irvine)
Stipsicz, Andras (Hungarian Academy of Sciences)
Stolz, Stephan (University of Notre Dame)
Teichner, Peter (University of California)
Vidussi, Stefano (Kansas State University)
Viro, Oleg (Uppsala universitet)
Vogtmann, Karen (Cornell University)
Wahl, Nathalie (University of Chicago)

Workshop on Analytic and Algebraic Methods in Complex and CR Geometry
September 3–8, 2005

Organizers:

John Bland (University of Toronto)
John D'Angelo (University of Illinois)
Joseph J. Kohn (Princeton University)
Laszlo Lempert (Purdue University)
Yum-Tong Siu (Harvard University)

The subject of several complex variables evinces a beautiful fusion of techniques from diverse areas of mathematics. Major results in the subject have used methods from PDE's, differential geometry, algebraic geometry, and commutative algebra. In turn several complex variables have contributed significantly to these subjects. For example, the algebraic geometry community has recently become actively involved in the study and use of multiplier ideal sheaves. This subject has its roots in separate works of Skoda and Kohn from the 1970's, each concerning aspects of L^2 estimates for d-bar. The subject of Cauchy-Riemann geometry (CR geometry) concerns both the tangential Cauchy-Riemann equations and a mixture of real and complex geometry. CR geometry blends techniques from algebraic geometry, contact geometry, complex analysis and PDE's; it provides additional evidence of outgrowth from these synergies. It is worthwhile to note that early work in CR geometry led Hans Lewy to his famous example of a nonsolvable PDE. There has been a great deal of work relating algebraic geometry and resolution of singularities to regularity results for PDE's and CR geometry. This workshop was designed to bring people together from these diverse fields, and encourage interplay among these areas.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5086/

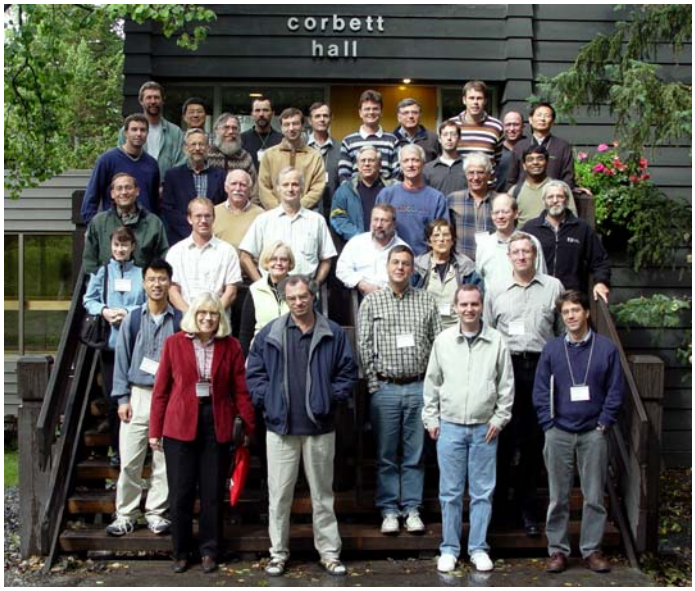
Participants:

Bland, John (University of Toronto)
Boggess, Al
Brudnyi, Yuri (Technion - Israel Institute of Technology)
Catlin, David (Purdue University)
Christ, Michael (UC-Berkeley)
Cuckovic, Zeljko (University of Toledo)
D'Angelo, John (University of Illinois)
de Oliveira, Bruno (University of Miami)
Ebenfelt, Peter (UC-San Diego)
Epstein, Charlie (University of Pennsylvania)
Fu, Siqi (Rutgers University-Camden)
Greiner, Peter (University of Toronto)
Heier, Gordon (University of Michigan)
Huang, Xiaojun (Rutgers University)
Hwang, Jun-Muk (Korea Institute for Advanced Study)
Kohn, Joseph J. (Princeton University)
Larusson, Finnur (University of Western Ontario)
Lazarsfeld, Robert (University of Michigan)
Lempert, Laszlo (Purdue University)
Mabuchi, Toshiki (Osaka University)
McNeal, Jeffery (Ohio State University)
Melrose, Richard (MIT)
Milman, Pierre (University of Toronto)
Miyaoka, Yoichi (University of Tokyo)
Nicoara, Andreea (Harvard University)
Ohsawa, Takeo (Nagoya University)
Ponge, Raphael (University of Toronto)
Shaw, Mei-Chi (University of Notre Dame)
Siu, Yum-Tong (Harvard University)
Stolovitch, Laurent (CNRS-Université Paul Sabatier)
Straube, Emil (Texas A&M University)
Tartakoff, David (University of Illinois at Chicago)
Tie, Jingzhi (University of Georgia)
Varolin, Dror (Stony Brook University)
Yeung, Sai-Kee (Purdue University)
Zhou, Xiangyu (Math Institute of the Chinese Academy of Sciences)

Interactions between Noncommutative Algebra and Algebraic Geometry
September 10–15, 2005

Organizers:

Michael Artin (Massachusetts Institute of Technology)
Colin Ingalls (University of New Brunswick)
Zinovy Reichstein (University of British Columbia)
Lance Small (University of California, San Diego)
James Zhang (University of Washington)



Noncommutative phenomena are perhaps as old as mathematics itself; they manifest themselves in the simplest mathematical objects, such as permutations or matrices. Noncommutative algebra developed into a separate subject in the early 20th century. The initial steps, taken by Dickson and Wedderburn, among others, were motivated by attempts to better understand "hypercomplex numbers", such as the quaternions, discovered by W. Hamilton in 1843. Subsequent steps, due to E. Artin, R. Brauer, H. Hasse, E. Noether, etc., came in the context of abstract algebra, which was a rapidly developing subject in the 1920s and 30s. The next phase, lasting roughly from the 1930s to the early 1980s and led by A. Albert, S. Amitsur, N. Jacobson, I. Kaplansky, A. Goldie, I. Herstein, among others, focused on developing the structure theory for various types of noncommutative rings. The purpose of the workshop was to discuss various aspects of the interaction between noncommutative ring theory and algebraic geometry, including the latest developments in noncommutative algebraic geometry. In particular, topics where there have been interesting new developments in recent years were discussed.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5035/

Participants:

Alev, Jacques (Universit'e de Reims)
Behrend, Kai (UBC)
Bell, Jason (University of Michigan)
Braun, Amiran (University of Haifa)
Brown, Ken (University of Glasgow)
Chan, Daniel (University of New South Wales)
Crawley-Boevey, William (University of Leeds)
Ginzburg, Victor (University of Chicago)
Goodearl, Ken (UC-Santa Barbara)
Gordon, Iain (University of Edinburgh)
Hacking, Paul (Yale University)
Huisgen-Zimmermann, Birge (UC-Santa Barbara)
Ingalls, Colin (University of New Brunswick)
Keeler, Dennis (Miami University)
Keller, Bernhard (University Denis Diderot-Paris 7)
Kirkman, Ellen (Wake Forest University)
Kulkarni, Rajesh (Michigan State University)
Lenagan, Tom (University of Edinburgh)
Lorenz, Martin (Temple University)
Lunts, Valery (Indiana University)
Makar-Limanov, Leonid (Wayne State University)
Montgomery, Susan (University of Southern California)
Nyman, Adam (University of Montana)
Reichstein, Zinovy (UBC)
Reiten, Idun (Norwegian University of Science & Technology)
Rogalski, Daniel (MIT)
Rosenberg, Alexander (Kansas State University)
Rowen, Louis (Bar-Ilan University)
Saltman, David J (University of Texas)
Shelton, Brad (University of Oregon)
Small, Lance (UC-San Diego)
Smith, Paul (University of Washington)
Stafford, Toby (University of Michigan)
Vancliff, Michaela (University of Texas at Arlington)
Vonessen, Nikolaus (University of Montana)
Wu, Quanshui (Fudan University)
Yekutieli, Amnon (Ben Gurion University)
Zhang, James (University of Washington)

Order, Disorder, and Transport: Recent Advances in Schrodinger Operator Theory
September 17–22, 2005

Organizers:

Richard Froese (University of British Columbia)
Peter Hislop (University of Kentucky)
Abel Klein (University of California, Irvine)

The last 10 years have seen many advances in the study of Schrödinger operators. The purpose of the workshop was to highlight these advances, and to bring together researchers in various areas so that methods and techniques can be exchanged. The topics were limited to three related areas: ordered quantum systems, disordered quantum systems, and the transport properties of quantum systems.

The workshop was timely and extremely useful for the field. There was a lot of momentum to attack some of the more difficult and deep open problems. Several harmonic analysts had been working recently in the field. They brought to it new techniques that have advanced several of the topics discussed above, such as the spectral properties of operators with periodic coefficients and quasiperiodic potentials. Advances in physics in the areas such as quasicrystals and photonic crystals, coupled with our increased understanding of random systems, had formed a ripe environment for accurate modeling of these physical systems. It was a great opportunity for the young researchers in this field to meet.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5051/

Participants:

Aizenman, Michael (Princeton University)
Bellissard, Jean (Georgia Institute of Technology)
Combes, Jean Michel (Universite de Sud)
Damanik, David (California Institute of Technology)
de Oliveira, Gustavo (UBC)
Denissov, Serguei (University of Wisconsin-Madison)
Erdos, Laszlo (Ludwig Maximilians Universitat Muenchen)
Esposito, Pierpaolo (UBC)
Figotin, Alexander (UC-Irvine)
Froese, Richard (UBC)
Germinet, Francois (Universite de Cergy-Pontoise)
Graf, Gian Michele (Ecole Normale Supérieure de Lyon)
Hasler, David (UBC)
Herbst, Ira (University of Virginia)
Hislop, Peter (University of Kentucky)
Hundertmark, Dirk (University of Illinois)
Kang, Yang (UC-Irvine)
Killip, Rowan (UCLA)
Kirsch, Werner (Ruhr Universitat Bochum)
Klein, Abel (UC-Irvine)
Klopp, Frédéric (Université Paris Nord)
Kostrykin, Vadim (Fraunhofer Institute)
Kritchevski, Eugene (McGill University)
Last, Yoram (Hebrew University)
Lenoble, Olivier (UC-Irvine)
Leschke, Hajo (Universitat Erlangen-Nurnberg)
Mueller, Peter (UC-Irvine)
Nakano, Fumihiko (Kochi University)
Poulin, Philippe (McGill University)
Schenker, Jeffrey (ETH Zurich)
Schulz-Baldes, Hermann (Universitat Erlangen)
Simon, Barry (California Institute of Technology)
Sims, Robert (UC-Davis)
Spitzer, Wolfgang (UBC)
Stoiciu, Mihai (Williams College)
Ueki, Naomasa (Kyoto University)
Warzel, Simone (Princeton University)

Time-Frequency Analysis and Nonstationary Filtering
September 24–29, 2005

Organizers:

Hans Feichtinger (University of Vienna)
Karlheinz Groechenig (Institute of Biomathematics and Biometry)
Michael Lamoureux (University of Calgary)
Gary Margrave (University of Calgary)

This is an exciting moment in time-frequency analysis as the theory is evolving rapidly while new applications are also constantly emerging. Similar to the trend from linear to nonlinear problems, the move from stationary to nonstationary leads to a richer solution set but at the expense of greater mathematical and computational complexity. Stationary filtering has been an important signal processing tool in industry for many years but today we have an emerging understanding of nonstationary filtering that promises to have a immense impact on signal processing as well as the associated modelling of the real world. The rapid increase of available computing power makes the implementation of complex nonstationary filters possible today where they were only concepts a short while ago.

At the workshop, some of the top theoreticians in time-frequency analysis interacted with mathematical physicists and engineers, particularly those in geophysics and communications engineering where nonstationary filtering is a fundamental tool. Long-term collaboration between the theoreticians and the applied researchers was encouraged. While the former often have a deeper understanding of the potential of time-frequency analysis, the latter have access to physical data and are in touch with practical necessities such as computational limitations.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5026/

Participants:

Ali, S. Twareque (Concordia University/ Institut des Sciences Mathematiques)
Balazs, Peter (Austrian Academy of Science)
Benedetto, John (University of Maryland)
Bodmann, Bernhard (University of Waterloo)
Casazza, Peter (University of Missouri)
de Hoop, Maarten (Purdue University)
Drabycz, Sylvia (University of Calgary)
Feichtinger, Hans (University of Vienna)
Fishman, Lou (University of Calgary/ MDF International)
Fornasier, Massimo (University of Vienna/ University of Rome La Sapienza)
Gibson, Peter (York University)
Groechenig, Karlheinz (Institute of Biomathematics and Biometry)
Heil, Christopher (Georgia Tech)
Herrmann, Felix (UBC)
Hlawatsch, Franz (Vienna University of Technology)
Hogan, Chad (University of Calgary)
Jorgensen, Palle (The University of Iowa)
Klauder, John (University of Florida)
Kutyniok, Gitta (Justus-Liebig-University Giessen)
Lamoureux, Michael (University of Calgary)
Ma, Yongwang (University of Calgary)
Margrave, Gary (University of Calgary)
Mitchell, Ross (University of Calgary)
Okoudjou, Kasso (Cornell University)
Oliaro, Alessandro (University of Torino)
Pfander, Goetz (International University of Bremen)
Pinnegar, Robert (Calgary Scientific, Inc.)
Sacchi, Mauricio (University of Alberta)
Sastry, Challa (UBC)
Shen, Zuowei (National University of Singapore)
Stolk, Chris (University of Twente)
Strohmer, Thomas (UC-Davis)
Tanner, Jared (University of Utah)
Toft, Joachim (Växjö University)
Torresani, Bruno (Université de Provence)
Vaillancourt, Remi (University of Ottawa)
Vasudevan, Kris (University of Calgary)
Yedlin, Matt (UBC)

Challenges in Linear and Polynomial Algebra in Symbolic Computation Software
October 1–6, 2005

Organizers:

Wolfram Decker (Universitaet des Saarlandes)
Keith Geddes (University of Waterloo)
Erich Kaltofen (North Carolina State University)
Stephen Watt (University of Western Ontario)

The subject of the workshop was innovation in algorithms and software addressing key bottlenecks in symbolic mathematical computation software. By symbolic mathematical computation software we mean software like Maple, Mathematica, Macaulay 2, Magma, MuPAD, NTL, SINGULAR etc., whose purpose is to aid a mathematician, scientist, engineer, or educator to solve mathematical problems on a computer. The specific area of focus for this workshop was challenges arising from linear and polynomial algebra at the core of these systems.

This workshop provided a forum for focused discussion among the experts in industry and academia, and among algorithm designers and algorithm implementers. The goal was to understand a framework which would foster the evolution of new algorithmic ideas into usable software in a timely fashion.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5039/

Participants:

Brown, Chris (Naval Academy)
Decker, Wolfram (Universitaet des Saarlandes)
Demmel, James W. (UC-Berkeley)
Dewar, Michael (Numerical Algorithms Group Ltd.)
Dumas, Jean-Guillaume (Université de Grenoble, France)
Gathen, Joachim von zur (B-IT, University of Bonn, Germany)
Gerhard, Juergen (Maplesoft)
Giorgi, Pascal (University of Waterloo)
Greuel, Gert-Martin (University of Kaiserslautern, Germany)
Hubert, Evelyne (INRIA Sophia Antipolis France)
Kai, Hiroshi (Ehime University)
Kaltofen, Erich (North Carolina State University)
Labahn, George (University of Waterloo)
Lange, Tanja (Technische Universiteit Eindhoven)
Lazard, Daniel (National Institute for Research in Computer Science and Control, France)
Lee, Wen-shin (University of Antwerp, Belgium)
Monagan, Michael (SFU)
Pearce, Roman (SFU)
Rouillier, Fabrice (National Institute for Research in Computer Science and Control, France)
Salvy, Bruno (National Institute for Research in Computer Science and Control, France)
Saunders, B. David (University of Delaware)
Schost, Eric (Ecole Polytechnique France)
Schreyer, Frank-Olaf (University of des Saarlandes, Germany)
Sommese, Andrew (University of Notre Dame)
Steel, Allan (University of Sydney, Australia)
Stillman, Mike (Cornell University)
Storjohann, Arne (University of Waterloo)
van Hoeij, Mark (Florida State University)
Villard, Gilles (ENS Lyon France)
Watt, Stephen (University of Western Ontario)
Winkler, Franz (University of Linz Austria)
Zhi, Lihong (AMSS, Beijing, China)

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

Organizers:

Jim Bryan (University of British Columbia)
Michael Thaddeus (Columbia University)
Ravi Vakil (Stanford University)

The main goal of the workshop was to bring together researchers in algebraic geometry and physicists to foster lively interaction, leading to original ideas and new directions in research. Discussions were set up among several different groups whose expertise could lead to notable advances in algebraic geometry inspired by physics. These groups had much to teach each other. But this workshop was not a meeting of a merely instructional or expository nature. Just the opposite: we expected to stimulate research developments of the highest order, and the most current interest.

We do not know what the future holds, and we suspect it will already be very different in two years. We are confident that the boundary between physics and algebraic geometry will be even busier and more productive.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5081/

Participants:

Abramovich, Dan (Boston University)
Batyrev, Victor (University of Tubingen)
Bertram, Aaron (University of Utah)
Bryan, Jim (UBC)
Buch, Anders (Aarhus University)
Cadman, Charles (University of Michigan)
Caldararu, Andrei (University of Wisconsin)
Cavalieri, Renzo (University of Michigan)
Chen, Linda (Ohio State University)
Ciocan-Fontanine, Ionut (University of Minnesota)
Coskun, Izzet (MIT)
Craw, Alastair (Stony Brook University)
Gholampour, Amin (UBC)
Gottsche, Lothar (International Centre for Theoretical Physics)
Gross, Mark (UC-San Diego)
Hori, Kentaro (University of Toronto)
Jarvis, Tyler (Brigham Young University)
Kim, Bumsig (Korea Institute for Advanced Study)
Kimura, Takashi (Boston University)
Lee, Yuan-Pin (University of Utah)
Leung, Nai Chung (Conan) (The Chinese University of Hong Kong)
Li, Jun (Stanford University)
Mare, Augustin-Liviu (University of Regina)
Mizerski, Maciej (UBC)
Mustata, Andrei (University of Illinois, Urbana-Champaign)
Nakajima, Hiraku (Kyoto University)
Payne, Sam (Clay Institute/ Stanford University)
Purbhoo, Kevin (UBC)
Roth, Michael (Queen's University)
Shapiro, Jacob (UBC)
Song, Yinan (UBC)
Tamvakis, Harry (University of Maryland)
Thaddeus, Michael (Columbia University)
Tseng, Hsian-hua (UBC)
Vakil, Ravi (Stanford University)
Watts, Jordan (University of Calgary)

Growth and Control of Tumours
October 16–19, 2005

Organizers:

Jeff Lucas (MITACS)
Michael Mackey (McGill University)
Chris Sander (Sloan Kettering)
Siv Sivaloganathan (Waterloo University)
Kristin Swanson (University of Washington)
Jack Tuszynski (University of Alberta)

A mathematical oncology workshop focused on the growth and control of tumours took place at BIRS. The purpose of the meeting was to bring researchers from the mathematical sciences, medical practitioners/ researchers as well as individuals from the pharmaceutical industry together to discuss current problems in oncology and future challenges - both from the theoretical viewpoint of developing a deeper understanding of carcinogenesis (and subsequent stages of cancer) and more importantly, from the practical viewpoint of developing optimal treatment strategies and therapies.

The goals of this workshop included:
1. To act as a catalyst in stimulating research in mathematical oncology and its clinical implications.
2. To network individuals from medicine, academia and the pharmaceutical industry who are interested in drug development, design, testing and more generally in the optimization of therapies.
3. Discuss current problems and establish future directions.
4. Discuss/Create novel initiatives and opportunities for research collaborations between physicians, mathematicians and the pharmaceutical industry.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5101/

Participants:

Aguda, Baltazar (Bioinformatics Institute, Singapore)
Alvord, Ellsworth (University of Washington)
Ash, Walter (University of Calgary)
de Vries, Gerda (University of Alberta)
Harpold, Hana (University of Washington)
Hillen, Thomas (University of Alberta)
Jurisica, Igor (OCI/ UHN Toronto)
Komarova, Svetlana (McGill University)
Kurgan, Lukasz (University of Alberta)
Lucas, Jeff (MITACS)
Mackey, Michael (McGill University)
Meza, Rafael (University of Washington - FHCRC)
Partridge, Savannah (UW Medical Centre)
Sander, Chris (Sloan Kettering)
Sivaloganathan, Siv (Waterloo University)
Speziale, Sean (University of Waterloo)
Swanson, Kristin (University of Washington)
Tieleman, Peter (University of Calgary)
Tuszynski, Jack (University of Alberta)

Therapeutic Efficacy in Population Veterinary Medicine
October 19–22, 2005

Organizers:

Jacques Belair (Universite de Montreal)
Renée Bergeron (Université Laval)
Jérôme del Castillo (Université de Montréal)
Jun Li (Université de Montréal)
Jeff Lucas (MITACS)
Fahima Nekka (University of Montreal)
Don Schaffner (Rutgers University)

It is well recognized that inadequate antibiotic use reduces therapeutic efficacy and promotes the selection of bacteria with decreased susceptibility to antibiotics. In swine therapeutics, these drugs are delivered most frequently in feed or drinking water. As a consequence, animal feeding behaviour, feed type and antibiotic type, should have a profound influence on their systemic exposure to drugs, which is central to therapeutic efficacy. There is considerable variation in feeding behaviour, as well as in the way feed and antibiotics are absorbed by individual animals. This yields to a wide range of individual systemic drug exposures among treated animals. Under-exposure leads to treatment failure and to the selection of resistant bacteria, whereas over-exposure may increase the risk of drug toxicity and drug residues in meat. A better understanding of the various determinants and outcomes of therapeutic efficiency may be achieved through a multidisciplinary approach, in order to develop new treatment strategies that will be safer for animals and humans. Analysis and simulation using mathematical approaches add a quantitative dimension to the veterinary medicine, greatly decrease drug risk and cost and help optimizing therapy.

The goals of this workshop included:
1. To act as a catalyst in stimulating research in therapeutic efficacy in population veterinary medicine.
2. To network individuals from industry and researchers working in different fields related to drug efficacy, from applied mathematics, pharmacology, microbiology, nutrition, as well as behavioural and veterinary sciences.
3. Discuss current problems and establish future directions.
4. Discuss and create novel initiatives and opportunities for research collaborations between those active in applied mathematics, pharmacology, microbiology, nutrition, behavioural and veterinary sciences.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5201/

Participants:

Belair, Jacques (Universite de Montreal)
Bergeron, Renée (Université Laval)
Bernier, Dave (Université de Montréal)
del Castillo, Jérôme (Université de Montréal)
Eberl, Hermann (AFMnet/ University of Guelph)
France, James (AFMnet/ University of Guelph)
Gonyou, Harold (Prairie Swine Centre)
Groves, Bruce (Pfizer Animal Health Canada)
Hayes, Tony (University of Guelph)
Lafrance, Judith (Université Laval)
Letellier, Ann (Université de Montréal)
Lucas, Jeff (MITACS)
McLaughlin, Murray (AFMnet)
Miville, Claude (Fédération des producteurs de porcs du Québec)
Nekka, Fahima (Faculty of Pharmacy/ University of Montreal)
Paulson, Allan (AFMnet / Dalhousie University)
Petit-Jette, Caroline-Emmanuelle (Université de Montréal)
Pomar, Candido (Agriculture & Agri Food Canada)
Reid-Smith, Richard (Public Health Agency of Canada)
Sanche, Steven (Université de Montréal)
Schraft, Heidi (Lakehead University)
Theede, Alan (Pfizer Animal Health Canada)
Truelstrup, Lisbeth (AFMnet / Dalhousie University)
Yang, Laurence T. (St. Francis Xavier University)

Visco-Plastic Fluids: from Theory to Application
October 22–27, 2005

Organizers:

Neil Balmforth (University of British Columbia)

Ian Frigaard (University of British Columbia)

Visco-plastic materials are fluids that exhibit a yield stress: below a certain critical shear stress there is no deformation of the fluid and it behaves like a rigid solid, but when that yield value is exceeded, the material flows like a fluid. Such flow behaviour appears in many situations, including slurries and suspensions, certain polymer solutions, crystallizing lavas, muds and clays, heavy oils, avalanches, cosmetic creams, liquid chocolate, and some pastes. Consequently, the theory of the fluid mechanics of such materials has applications in wide array of fields, ranging from the oil, gas and chemical industries, to food processing and to geophysical fluid dynamics. Many developments have occurred in parallel within the mathematical, engineering, fluid mechanics and rheology communities. Yet these communities are not familiar with the detailed developments of each other. This workshop aimed to provide scientists, including younger researchers, with essential tools and techniques that they would not normally encounter within their own research groups. We hoped to evaluate the current status of the field, set out future directions for progress and appreciate the lessons learned so far.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5028/

Participants:

Alexandrou, Andreas (University of Cyprus)
Ancey, Christohe (Ecole Polytechnique Federale de Lausanne)
Balmforth, Neil (UBC)
Barnes, Howard (University of Wales, Aberystwyth)
Belmonte, Andrew (Pennsylvania State University)
Bildhauer, Michael (Saarland University)
Bonn, Daniel (ENS Paris/WZI Amsterdam)
Cochard, Steve (Ecole Polytechnique Federale de Lausanne)
Craster, Richard (Imperial College)
de Bruyn, John (University of Western Ontario)
de Souza Mendes, Paulo (Pontifícia Universidade Católica-RJ)
Dubash, Neville (Imperial College)
Entov, Vladimir (Institute for Problems in Mechanics, Russian Academy of Science, Moscow)
Frigaard, Ian (UBC)
Frisken, Barbara (Simon Fraser University)
Georgiou, Georgios (University of Cyprus)
Ghadge, Shilpa (UBC)
Glowinski, Roland (University of Houston)
Heuzey, Marie-Claude (Ecole Polytechnique)
Hogg, Andrew (Bristol)
Huilgol, Raj (Flinders University of South Australia)
Ionescu, Ioan (CNRS and University of Savoy)
Metivier, Christel (Institute Nationale Polytechnique de Lorraine-Nancy)
Mitsoulis, Evan (National Technical University of Athens)
Moller, Peder (Ecole Normale Superieure)
Naccache, Monica (Pontificia Universidade Catolica-Rio de Janeiro)
Nouar, Cherif (LEMTA Nancy)
Patterson, Mike (University of Cambridge)
Perona, Paolo (Swiss Federal Institute of Technology)
Peysson, Yannick (French Institute for Petroleum)
Pouliquen, Olivier (CNRS-University of Provence)
Putz, Andreas (UBC)
Sassi, Roberto (Università di Milano,Italy)
Shelukhin, Vladimir (LIH/ Novosibirsk)
Sherwood, John (Schlumberger Cambridge)
Slim, Anja (University of Cambridge)
Tsamopoulos, John (University of Patras)
Vola, Didier (IRSN France)
Wachs, Anthony (Institut Français du Pétrole, Paris)

Probabilistic Combinatorics: Recent Progress and New Frontiers
October 29–November 3, 2005

Organizers:

Noga Alon (Tel Aviv University)
Bruce Reed (McGill University)
Benny Sudakov (Princeton University)
Van Vu (University of California-San Diego)

Probabilistic Combinatorics is an interface between Probability and Discrete Mathematics. Initiated by P. Erdös over fifty years ago, it has now become one of the fastest developing areas in all mathematics, with fascinating applications to many other important areas, such as Theoretical Computer Science and Statistical Physics.

The workshop focused on all the main research topics of Probabilistic Combinatorics, including the application of probability to solve combinatorial problems, the study of random combinatorial objects and the investigation of randomized algorithms. One aim of the workshop was simply to foster interaction between researchers in these fields, discuss recent progress and communicate new results and ideas. We also intended to use this forum to make the main state-of-the-art probabilistic techniques available to a broader audience, including graduate students. Given the fast recent development of probabilistic techniques and their applications to various mathematical disciplines, it was an appropriate time to bring together researchers representing the whole spectrum of Probabilistic Combinatorics, so as to consolidate knowledge at present and set new horizons for future discoveries.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5054/

Participants:

Addario-Berry, Louigi (McGill University)
Barany, Imre (University College London)
Beck, Jozsef (Rutgers University)
Bohman, Thomas (Carnegi Mellon University)
Brightwell, Graham (London School of Economics)
Broutin, Nicolas (McGill University)
Chattopadhyay, Arkadev (McGill University)
Costello, Kevin (UC-San Diego)
Devroye, Luc (McGill University)
Erin Leigh, McLeish (McGill University)
Haxell, Penny (University of Waterloo)
Kahn, Jeff (Rutgers University)
Keevash, Peter (California Institute of Technology)
Kim, Jeong Han (Microsoft Research)
King, Andrew (McGill University)
Kohayakawa, Yoshiharu (University of Sao Paulo)
Loh, Po-Shen (Princeton University)
Pikhurko, Oleg (Carnegie Mellon University)
Reed, Bruce (McGill University)
Richardson, Ross (UC-San Diego)
Simonovits, Miklos (Hungarian Academy of Sciences)
Spencer, Joel (Courant Institute)
Steger, Angelika (ETH Zurich)
Sudakov, Benny (Princeton University)
Szemeredi, Endre (Rutgers-State University of New Jersey)
Tetali, Prasad (Georgia Institute of Technology)
Verstraete, Jacques (University of Waterloo)
Vondrak, Jan (Microsoft Research)
Vu, Van (UC-San Diego)
Wormald, Nick (University of Waterloo)
Wu, Lei (UC-San Diego)

Number Theory Inspired by Cryptography
November 5–10, 2005

Organizers:

David Boyd (University of British Columbia)
Carl Pomerance (Dartmouth College)
Igor Shparlinski (Macquarie University)
Hugh Williams (University of Calgary)

The objective of this workshop was to bring together 35-40 of the most active and productive researchers in number theory and cryptography, especially those with expertise in computational number theory, who are eager to share their expertise and are open to working on new topics. Cryptographers brought new problems and ideas to the number theoretic community. Developments in both number theory and cryptography are both numerous and rapid; however, it is often the case that lack of contacts and communication between cryptographers and number theorists present obstacles in achieving significant advances on both sides. We hoped to overcome these obstacles and foster new links between both areas.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5021/

Participants:

Ahmadi, Omran (University of Toronto)
Banks, William (University of Missouri-Columbia)
Bauer, Mark (University of Calgary)
Bennett, Michael (UBC)
Bernstein, Dan (University of Illinois)
Berrizbeitia, Pedro (Universidad Simon Bolivar)
Blake, Ian (University of Toronto)
Bleichenbacher, Daniel (Lucent Technologies)
Boyd, David (UBC)
Bruin, Nils (SFU)
Charles, Denis (Microsoft Research)
Cheng, Qi (University of Oklahoma)
Déchène, Isabelle (University of Waterloo)
Frey, Gerhard (Institut für Experimentelle Mathematik/ Universität Gesamthochschule Essen)
Friedlander, John (University of Toronto- Scarborough)
Jacobson, Michael (University of Calgary)
Lange, Tanja (Technische Universiteit Eindhoven)
Lauter, Kristin (Microsoft Research)
Lee, Yoonjin (SFU)
Luca, Florian (UNAM, Mexico)
Morain, Francois (Ecole Polytechnique, Paris)
Murty, Kumar (University of Toronto)
Pacelli, Allison (Williams College)
Satoh, Takakazu (Tokyo Institute of Technology)
Scheidler, Renate (University of Calgary)
Schirokauer, Oliver (Oberlin College)
Shparlinski, Igor (Macquarie University)
Silverberg, Alice (UC-Irvine)
Sorenson, Jonathan (Butler University)
Stein, Andreas (University of Wyoming)
Teske, Edlyn (University of Waterloo)
Thériault, Nicolas (University of Waterloo)
van der Poorten, Alf (Centre for Number Theory Research, Sydney)
Wagstaff, Samuel (Purdue University)
Walsh, Gary (University of Ottawa/ CSE)
Watkins, Mark (Bristol University)
Williams, Hugh (University of Calgary)

Homotopy Theory and Group Actions
November 12–17, 2005

Organizers:

Alejandro Adem (University of British Columbia)
William Dwyer (Notre Dame University)
Richard Kane (University of Western Ontario)
Clarence Wilkerson (Purdue University)

This workshop brought together representatives from two distinct research communities algebraic topology and group theory - in order to promote and advance several interrelated research programs. There has been a long and fruitful interaction between group theory and algebraic topology over the past fifty years. In the past few decades the relationship has been centred in the areas of representation theory and the cohomology of groups with a focus on understanding large classes of groups via the analysis of their classifying spaces. Indeed this program has become a core subject in algebraic topology. The study of symmetry groups of topological spaces has been another important theme for interaction between the two areas. It has become increasingly apparent in the past few years that the study of group actions in the context of algebraic topology is poised for a new surge of activity.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5102/

Participants:

Adem, Alejandro (UBC)
Alperin, Jonathan (University of Chicago)
Andersen, Kasper (Aarhus University)
Aschbacher, Michael (CalTech)
Bauer, Kristine (University of Calgary)
Benson, David (University of Aberdeen)
Cantarero-Lopez, Jose Maria (UBC)
Carlson, Jon (University of Georgia)
Castellana, Natalia (Universidad Autonoma de Barcelona)
Chermak, Andrew (Kansas State University)
Combariza, German (UBC)
Davis, Jim (Indiana University)
Duman, Ali Nabi (UBC)
Dwyer, William (Notre Dame University)
Grodal, Jesper (Chicago/Copenhagen)
Hambleton, Ian (McMaster University)
Jackson, Michael (University of Rochester)
Juan-Pineda, Daniel (UNAM, Mexico)
Kane, Richard (University of Western Ontario)
Kudryavtseva, Elena (University of Calgary/ Moscow State University)
Leary, Ian (Ohio State University)
Levi, Ran (University of Aberdeen)
Linckelmann, Markus (University of Aberdeen)
Moeller, Jesper (University of Copenhagen)
Neusel, Mara D. (Texas Tech University)
Oliver, Bob (Universite Paris 13)
Pakianathan, Jonathan (University of Rochester)
Peschke, George (University of Alberta)
Ragnarsson, Kari (University of Aberdeen)
Smith, Larry (Goettingen University)
Smith, Stephen (University of Illinois at Chicago)
Solomon, Ronald Mark (The Ohio State University)
Spiga, Pablo (University of Lethbridge)
Springer, Tonny (Universiteit Utrecht)
Stancu, Radu (Ohio State University)
Unlu, Ozgun (McMaster University)
Viruel, Antonio (University of Malaga)
Webb, Peter (University of Minnesota)
Wilkerson, Clarence (Purdue University)

Flavors of Groups
November 17–22, 2005

Organizers:

Mladen Bestvina (University of Utah)
Jeffrey Brock (Brown University)
Jon Carlson (University of Georgia)
Persi Diaconis (Stanford University)
Hugo Rossi (Mathematical Sciences Research Institute)

The workshop brought together mathematicians working on algebraic, analytic, combinatoric, geometric and topological aspects of group theory in order to strengthen each of these approaches through an exchange of techniques and ideas. The focus was on these four topics:

Geometric Group Theory. This is a relatively young field, with older and deeper roots in the study of groups from combinatorial and topological perspectives.

Kleinian Groups. The study and application of recent advances in the classification of hyperbolic 3-manifolds (the solution of the tameness and ending lamination conjectures of Marden and Thurston) can lead to a better understanding of the geometry of closed hyperbolic 3-manifolds.

Combinatorial Representation Theory. There is a productive interplay between combinatorics, geometry, finite groups, Lie theory and hyperplane arrangements in the applications to representation theory.

Representation Theory of Finite Groups. Current research centers on many open questions, particularly regarding representations over the integers or rings of positive characteristic.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5105/

Participants:

Barcelo, Helene (Arizona State University)
Benson, David (University of Aberdeen)
Brock, Jeffrey (Brown University)
Bromberg, Kenneth (University of Utah)
Canary, Richard (University of Michigan)
Cannon, Jim (Brigham Young University)
Carlson, Jon (University of Georgia)
Charney, Ruth (Brandeis University)
Diaconis, Persi (Stanford University)
Erdmann, Karin (University of Oxford)
Grodal, Jesper (Chicago/Copenhagen)
Hamenstaedt, Ursula (Universität Bonn)
Kamnitzer, Joel (American Institute of Mathematics / Massachusetts Institute of Technology)
Kerckhoff, Steven (Stanford University)
Kleshchev, Alexander (University of Oregon)
Malle, Gunter (Universitaet Kaiserslautern)
Masur, Howard (University of Illinois)
McCammond, Jon (UC-Santa Barbara)
Mosher, Lee (Rutgers University-Newark)
Pettet, Alexandra (University of Chicago)
Postnikov, Alex (MIT)
Reid, Alan (University of Texas, Austin)
Rickard, Jeremy (University of Bristol)
Robinson, Geoffrey (University of Aberdeen)
Rossi, Hugo (Mathematical Sciences Research Institute)
Sapir, Mark (Vanderbilt University)
Souto, Juan (University of Chicago)
Thiem, Nat (Stanford University)
Valette, Alain (Universite de Neuchatel)
Vinroot, Christopher Ryan (University of Arizona)
Vogtmann, Karen (Cornell University)
Williams, Lauren (UC-Berkeley)

Canada-Chile Meeting on the Mathematics of Economic Geography and Natural Resource Management
November 26–December 1, 2005

Organizers:

Ivar Ekeland (Pacific Institute for the Mathematical Sciences)
Alejandro Jofre (CMM, University of Chile)

The management of natural non-renewable resources -be it oil and mineral deposits, land, forestry and biodiversity, clean air and water- is quickly becoming the major international problem of the day. Some of the mathematics involved can be very problem-specific, but there are also some general issues which impact the whole field. There is the computation of economic equilibrium in situations which differ from the standard Arrow-Debreu model:

- equilibrium and optimization in the presence of uncertainty, particularly in cases when part of the information is acquired as one goes,
- equilibrium in spatial economics, where agents are competing for the use of land,
- equilibrium in hedonic models, where goods are non-homogeneous, and are priced according to quality.

In each of these classes of problems, beside the classical theoretical problems such as existence and uniqueness there are major practical issues: computation of equilibrium, and identification of model parameters from equilibrium price. One is also interested in investigating how equilibrium arises in the first place, possibly by a process of evolution and/or learning.

The aim of this workshop was to share the experience of CMM and PIMS on these problems, and to constitute international teams of researchers which will investigate these issues in the long term.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5103/

Participants:

Agueh, Martial (University of Victoria)
Alvarez, Felipe (CMM & DIM University of Chile)
Arre, Manuel (UBC)
Bauschke, Heinz (UBC-Okanagan)
Bose, Chris (University of Victoria)
Carlier, Guillaume (Universite Paris Dauphine)
Choksi, Rustum (SFU)
Cisternas, Gonzalo (Universidad de Chile)
Davila, Juan (CMM & DIM University of Chile)
Ekeland, Ivar (PIMS)
Figueroa, Nicolas (Universidad de Chile)
Gajardo, Pedro (Universidad de Chile)
Garcia, Javier (UBC)
Horst, Ulrich (UBC)
Jara, Pedro (PSE-EHESS, DIM - Universidad de Chile)
Jofre, Alejandro (CMM, University of Chile)
Lucet, Yves (UBC-Okanagan)
Manasevich, Raul (University of Chile)
Moroni, Sofia (Universidad de Chile)
Mueller, Matthias (PIMS)
Pang, Jong-Shi (Rensselaer Polytechnic Institute)
Parkinson, Anita (UBC)
Queyranne, Maurice (UBC)
Ramirez C., Hector (DIM University of Chile)
Rivera, Jorge (Dept. Economia, University of Chile)
Rockafellar, R.Terry (University of Washington)
Sorin, Sylvain (Université Pierre et Marie Curie Paris 6)
Trummer, Manfred (SFU)
Wang, Shawn (UBC)
Wets, Roger (UC-Davis)

Recent Advances in Symplectic Geometry - Celebrating Dusa McDuff's 60th Birthday December 3–8, 2005

Organizers:

Yakov Eliashberg (Stanford University)
Helmut Hofer (New York University)
John Milnor (SUNY at Stony Brook)
Dietmar Salamon (ETH Zurich)

The objective of this workshop was to bring the leading experts of symplectic geometry together to exchange ideas. The field of symplectic geometry has a large interface to other mathematical disciplines, like algebraic geometry, differential topology (particularly in small dimensions) and dynamical systems to name a few, and occurs as a fundamental structure in physics itself. There are many new developments. The workshop was concerned with the following topics: Enumerative real algebraic geometry, the topology of Lagrangian embeddings, Lefschetz pencils and near symplectic structure, Floer Field Theory, Hamiltonian group actions and Hamiltonian dynamics, string topology and symplectic field theory, geometry of symplectic diffeomorphism groups, and symplectic methods in the topology of three-manifolds.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5104/

Participants:

Abbas, Casim (Michigan State University)
Abreu, Miguel (Instituto Superior Técnico, Lisboa)
Anjos, Silvia (Instituto Superior Técnico, Lisboa)
Audin, Michele (Universite Louis Pasteur, Strasbourg)
Auroux, Denis (MIT)
Biran, Paul (Tel-Aviv University)
Buse, Olga (Indiana University Purdue Universitry Indianapolis)
Cieliebak, Kai (Ludwig-Maximilians-Universitaet)
Coffey, Joe (Stanford University)
Cornea, Octav (Universite de Montreal)
Ekholm, Tobias (University of Southern California)
Eliashberg, Yakov (Stanford University)
Etnyre, John (University of Pennsylvania/ Georgia Tech)
Ginzburg, Viktor (UC-Santa Cruz)
Gurel, Basak (State University of New York, Stony Brook)
Hofer, Helmut (New York University)
Karshon, Yael (University of Toronto)
Kerman, Ely (University of Illinois at Urbana-Champaign)
Kirby, Robion (UC-Berkeley)
Kronheimer, Peter (Harvard University)
Lalonde, Francois (Universite de Montreal)
McDuff, Dusa (Stony Brook University)
Milnor, John (SUNY at Stony Brook)
Mrowka, Tom (MIT)
Oh, Yong-Geun (University of Wisconsin, Madison)
Ozsvath, Peter (Columbia University)
Polterovich, Leonid (Tel Aviv University)
Ruan, Yongbin (University of Wisconsin-Madison)
Salamon, Dietmar (ETH Zurich)
Schwarz, Matthias (University of Leipzig)
Seidel, Paul (University of Chicago)
Shirokova, Nadya (Stanford)
Symington, Margaret (Mercer University/ Georgia Institute of Technology)
Tolman, Susan (University of Illinois at Urbana-Champaign)
Traynor, Lisa (Bryn Mawr College)
Viterbo, Claude (Ecole Polytechnique Palaiseau)
von Bergmann, Jens (University of Calgary)
Wehrheim, Katrin (IAS)
Welschinger, Jean-Yves (École normale supérieure de Lyon)
Wysocki, Kris (Penn State University)

Regulators II
December 10–15, 2005

Organizers:

James Lewis (University of Alberta)

Victor Snaith (University of Sheffield)

The recent work by Voevodsky in constructing the "motivic cohomology" theory as suggested by Grothendieck, and the resulting homological machinery associated to his approach, and its subsequent use to solve the longstanding Milnor conjecture, resulted in his winning the Fields medal in 2002. This provides an infusion of new and powerful ideas in the study of regulators. Indeed Voevodsky proved that his definition of motivic cohomology agrees with two other versions already used in regulator theory. Thus one can arguably make the case that regulators are maps (sometimes called "realizations") from Voevodsky motivic cohomology, albeit still hard to compute, to the "more computable" cohomology theories (Deligne, 'etale, absolute Hodge, etc.). It is often the case that regulator maps can have highly nontrivial kernels and images, which leads to higher order invariants associated motivic cohomology groups. This is generally the case if one works with varieties over the complex numbers, or even function fields of transcendence degree 1 over the rational numbers.

The meeting allowed the various groups of experts viewing the subject of regulators either arithmetically, topologically (as in Voevodsky's work, or as well as in terms of Lawson's homology), or transcendentally (i.e. Hodge theory) to compare notes.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w5032/

Participants:

Asakura, Masanori (Kyushu University)
Bloch, Spencer (University of Chicago)
Brosnan, Patrick (UBC)
Buckingham, Paul (University of Sheffield)
Choo, Zacky (University of Sheffield)
Cisneros-Molina, Jose Luis (Mathematics Institute Cuernavaca, UNAM)
Colwell, Jason (UC-San Diego)
de Jeu, Rob (University of Durham)
del Angel, P. Luis (Center of Investigations in Mathematics)
Elizondo, E. Javier (Universidad Nacional Autonoma de Mexico)
Esnault, Helene (Universitaet Duisburg-Essen)
Gangl, Herbert (Max Planck Institute for Mathematics)
Geisser, Thomas (University of Southern California)
Gillet, Heri (University of Illinois-Chicago)
Hanamura, Masaki (Tohoku University)
Joshua, Roy (Ohio State University/ MPI, Bonn)
Kerr, Matt (University of Chicago)
Kimura, Kenichiro (University of Tsukuba)
Kolster, Manfred (McMaster University)
Langer, Andreas (University of Exeter, UK)
Lewis, James (University of Alberta)
Lima-Filho, Paulo (Texas A&M University)
Maillot, Vincent (Institut de Mathematiques de Jussieu)
Mueller-Stach, Stefan (University of Mainz)
Raskind, Wayne (University of Southern California)
Roessler, Damian (CNRS, Institut de Mathematiques de Jussieu)
Rosenschon, Andreas (SUNY at Buffalo)
Saito, Shuji (University of Tokyo)
Snaith, Victor (University of Sheffield)
Spiess, Michael (Bielefeld University)
Sreekantan, Ramesh (Tata Institute of Fundamental Research/ Max Plack Institute fuer Mathematics)
Weiss, Al (University of Alberta)
Wojtkowiak, Zdzislaw (University of Nice)
Yee, Wai Ling (University of Alberta)
Zigmond, Robin (University of Durham, UK)

Banff International Research Station

2005

2-day Workshops

Second Northwest Functional Analysis Symposium
March 17–19, 2005

Organizers:

Doug Farenick (University of Regina)
Marcelo Laca (University of Victoria)
Michael Lamoureux (University of Calgary)
Volker Runde (University of Alberta)

This meeting was intended as a successor to the Northwest Functional Analysis Symposition in March 2003, held in BIRS and organized by M. Lamoureux (Calgary), A. T.-M. Lau (Edmonton), I. Putnam (Victoria), and N. Tomczak-Jaegermann (Edmonton). The purpose of the meeting was the same as for its predecessor: to bring together researchers in functional analysis from universities in Western Canada and to provide a platform for fruitful interaction between them. We planned to schedule about a dozen talks - varying in length between 20 and 40 minutes -, so that plenty of free time should remain for informal discussion between participants. Preference of speakers selection was given to junior faculty, postdoctoral fellows, and sufficiently advanced graduate students.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2089/

Participants:

Argerami, Martin (University of Regina)
Bezdek, Karoly (University of Calgary)
Binding, Paul (University of Calgary)
Bisztriczky, Ted (University of Calgary)
Brenken, Berndt (University of Calgary)
Brudnyi, Alex (University of Calgary)
Desaulniers, Shawn (University of Alberta)
Erlijman, Juliana (University of Regina)
Farenick, Doug (University of Regina)
Goncalves, Daniel (University of Victoria)
Husain, Ali-Amir (University of Alberta)
Laca, Marcelo (University of Victoria)
Laflamme, Claude (University of Calgary)
Lamoureux, Michael (University of Calgary)
Lau, Anthony To-Ming (University of Alberta)
Litvak, Alexander (University of Alberta)
Manjeghani, S. Mahmoud (University of Regina)
Nikolaev, Igor (University of Calgary)
Papish, Vlad (University of Victoria)
Phillips, John (University of Victoria)
Pivovarov, Peter (University of Alberta)
Pollock, Dan (University of Victoria)
Putnam, Ian (University of Victoria)
Rangipour, Bahram (University of Victoria)
Reznikoff, Sarah (Reed College)
Runde, Volker (University of Alberta)
Samei, Ebrahim (University of Manitoba)
Sourour, Ahmed Ramzi (University of Victoria)
Spurny, Jiri (University of Alberta)
Starling, Charles (University of Victoria)
Tcaciuc, Adi (University of Alberta)
Tomczak-Jaegermann, Nicole (University of Alberta)
Troitsky, Vladimir (University of Alberta)
Uygul, Faruk (University of Alberta)
Whittaker, Michael (University of Victoria)
Zhang, Yong (University of Manitoba)

Math Fair Workshop
April 21–23, 2005

Organizers:

Ted Lewis (University of Alberta)
Andy Liu (University of Alberta)

This was a continuation of the BIRS math fair workshops held in the spring of 2003 and 2004. The focus of these workshops was Mathematics Education, and the participants were teachers and educators elementary schools, junior high schools, colleges and universities, and also people from other institutions and organizations that have a deep interest in Mathematics Education.

As with the two previous workshops, the purpose of this workshop was to help teachers learn how to run a successful math fair, to exchange information about math fairs, and to put the members of this diverse group in contact with each other. The deeper purpose was to change the mathematical culture in the classroom, and we believe that this is beginning to happen. For the most part, the math fairs have been held in Alberta.

The BIRS math fair workshops have helped in spreading the word about the success of our type of math fair (which is radically different from a traditional science fair) and now such math fairs have been held several provinces in Canada, in some states in the US, in Sweden, and reports have been received that a math fair based on our principles has been held in Africa.

As just one example of the local effect of this year's BIRS math fair workshop, the Edmonton Catholic School Board is involving a large number of schools in presenting math fairs in the 2005/2006 school year.

Schools in other districts are doing similar things, and teachers have reported evidence that the math fair has changed classroom attitudes to the extent that students' success rates in mathematics have dramatically increased.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2608/

Participants:

Borowiecki, Helen (St. Vincent School)
Boychuk, Halia (Bluequills College)
Campbell, Cathy (Talmud Torah School)
Cannon, Jane (University College of the Fraser Valley)
Carlson, Scott (Strathmore High School)
Chasse, Danielle (Our Lady of the Prairies)
Conroy, Heather (St. Basil School)
Dammann, Randy ()
Danchuk, Jody (Olympic Heights Elementary)
Estabrooks, Manny (Red Deer College)
Ferris, Con (Red Deer College)
Friesen, Sharon (University of Calgary)
Gelasco, Lisa (Annunciation)
Geretschlaeger, Robert (BRG Kepler, Graz/Austria)
Girvan, Doug (Red Deer College)
Gordon, Christie (Olympic Heights Elementary)
Griffiths, Christine (Muriel Martin School)
Hansen, Margaret (Leo Nickerson School)
Hohn, Tiina (Grant MacEwan College)
Holloway, Tom (University of Alberta)
Hubbard, Barb (Keenooshayo School)
Isaac, Vince (Annunciation)
Jones, Daryl (St Mary School)
Keanie, Marlene (Keenooshayo School)
Kuntz, Lisa (Wellington Jr High School)
Lagu, Indy (Mount Royal College)
Lee, Jennifer (Edmonton Catholic Schools)
Lewis, Ted (University of Alberta)
Liu, Andy (University of Alberta)
Livingstone, Kate (Olympic Heights School)
Mitchell, Shirley (PIMS U of A)
Pouliot, Leanne (St. John Bosco)
Rice, Karla (St. Paul School)
Smart, Brenda (Keenooshayo School)
Sun, Wen-Hsien (Chiu Chang Mathematics Education Foundation)
Thomas, Elise (Olympic Heights School)
Thompson, Tanya (Ontario Schools)
Trask, Vanessa (Wellington School)
Yarovenko, Boyan (St. Martin School)
Yarovenko, Halia (St. Vincent School)

The Dark Side of Extra Dimensions
May 12–14, 2005

Organizers:

Valeri Frolov (University of Alberta/ Institute of Theoretical Physics)
Lee Grimard (University of Alberta)

The "Dark Side of extra Dimensions" workshop allowed the top researchers working in the field of topologically nontrivial objects in higher-dimensional gravitational theory to discuss their work and exchange new ideas. It brought together experts in theoretical, mathematical, and numerical physics, and used complementary approaches to these problems.

One of the reasons why the higher dimensional theories becomes so popular recently is a possibility that in the presence of extra dimensions one can expect creation of mini black holes in future collider and cosmic ray experiments. At the workshop, a detailed overview of the corresponding results were given and concrete physical problems which were to be solved for better understanding of such processes were formulated.

To summarize, the workshop gave very nice view of the state of art in the higher dimensions physics and mathematics of dark objects. It has very enthusiastic support and many of participants proposed to organize again a workshop on a similar subject in future.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2041/

Participants:

Ahmadi, Morteza (University of Lethbridge)
Barrabes, Claude (University of Tours, France)
Choptuik, Matthew (UBC)
Coley, Alan (Dalhousie University)
Das, Saurya (University of Lethbridge)
Fabbri, Alessandro (Universita' di Bologna, Italy)
Frolov, Valeri (University of Alberta/ Institute of Theoretical Physics)
Frolov, Andrei (Stanford University)
Gegenberg, Jack (University of New Brunswick)
Gergely, Laszlo (University of Szeged)
Grimard, Lee (University of Alberta)
Hobill, David (University of Calgary)
Husain, Viqar (University of New Brunswick)
Jacobson, Ted (University of Maryland)
Kang, Gungwon (Korea Institute for Advanced Study)
Kim, Sang Pyo (Kunsan National University)
Kol, Barak (Hebrew University)
Kunstatter, Gabor (University of Winnipeg)
Kunzle, Hans-Peter (University of Alberta)
Lake, Kayll (Queen's University)
Landsberg, Greg (Brown University)
Lee, Hyun Kyu (Hanyang University)
Mann, Robert (University of Waterloo)
Myers, Robert (University of Waterloo)
Pavluchenko, Sergey (University of Alberta)
Peet, Amanda (University of Toronto)
Schleich, Kristin (UBC)
Seahra, Sanjeev (University of Portsmouth)
Solodukhin, Sergey (International University Bremen, Germany)
Sorkin, Evgeny (Racah Institute of Physics)
Witt, Don (UBC)
Witten, Louis (University of Cincinnati)
Woolgar, Eric (University of Alberta)

Convex and Abstract Polytopes
May 19–21, 2005

Organizers:

Ted Bisztriczky (University of Calgary)
Egon Schulte (Northeastern University)
Asia Ivic Weiss (York University)

The rapid development of polytope theory in the past thirty years has resulted in a rich theory featuring an attractive interplay of several mathematical disciplines. The 2-day Workshop was evidence that polytope theory is very much alive and is the unifying theme of a lot of research activity.

The Workshop provided a much desired opportunity to share recent developments and emerging directions on geometric, combinatorial, and abstract aspects of polytope theory. We had twenty-nine official participants (among them seven women, two graduate students, and many junior faculty), plus a number of graduate student participants not officially registered. With few exceptions, the participants came from North-America. It is noteworthy that the last major meeting on convex and abstract polytopes was the NATO Advanced Study Institute on "Polytopes - Abstract, Convex and Computational" in 1993 at Scarborough, Ontario.

The 2-day Workshop at BIRS was followed by a Polytopes Day in Calgary *at the University of Calgary on Sunday, May 22, 2005, with two invited 50-minute lectures and five 20-minute talks, as well as two state of the art discussions (problem sessions), one on convex polytopes and one on abstract polytopes. Both Workshops were very favorably received by the participants and were viewed as a success. In particular, they prompted collaboration among participants with several papers as outcome.*

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2037/

Participants:

Bayer, Margaret (University of Kansas, Lawrence)
Bezdek, Karoly (University of Calgary)
Bisztriczky, Ted (University of Calgary)
Bracho, Javier (National University of Mexico)
Burgiel, Heidi (Bridgewater State College)
Csikos, Balazs (Eotvos University, Institute of Mathematics)
Dawson, Robert J.M. (Saint Mary's University)
Dinh, Thi (University of Calgary)
Edmonds, Allan (Indiana University)
Erdahl, Robert (Queens University)
Finbow-Singh, Wendy (Acadia University)
Gavrilova, Marina (University of Calgary)
Hartley, Michael (University of Nottingham, Malaysia)
Heppes, Aladar (Renyi Institute)
Herman, Allen (University of Regina)
Hubard, Isabel (York University)
Johnson, Norman W. (Wheaton College)
Lawrence, Jim (George Mason University)
Lee, Carl (University of Kentucky)
Ling, Joseph (University of Calgary)
Martini, Horst (Technische Universitaet Chemnitz)
Monson, Barry (University of New Brunswick)
Pellicer Covarrubias, Daniel (National University of Mexico)
Rybnikov, Konstantin (University of Massachusetts, Lowell)
Schmidt, Laura (University of Wisconsin-Stout)
Schulte, Egon (Northeastern University)
Soltan, Valeriu (George Mason University)
Weiss, Asia Ivic (York University)
Williams, Gordon (Moravian College)

Meeting of Canadian CS Chairs - CACS/AIC
June 9–11, 2005

Organizers:

Ken Barker (University of Calgary)
Gord McCalla (University of Saskatchewan)

The Department Heads/Chairs of Computer Science meet annually to share ideas, discuss problems facing the community, and set directions that are in the best of interest of all Computer Science Departments across the country. Each year the venue changes to encourage those from various regions to attend the meeting even if they are challenged financially. The 2005 meeting was hosted by the University of Calgary and BIRS generously offered to host the meeting as a part of their series in Banff.

Unlike other BIRS workshops the purpose of this meeting was primarily administrative rather than being focused on addressing a particular research question. The meeting consisted of a wide range of topics including: Research Challenges facing the discipline, Graduate student funding and education, NSERC grants and funding issues, Software Engineering, Computer Science Department Accreditation, Establishing Awards for top ranked students, and Development of committees to initialize various initiatives.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2602/

Participants:

Banzhaf, Wolfgang (Memorial University of Newfoundland)
Barker, Ken (University of Calgary)
Bassett, Paul (Canadian Information Processing Society)
Bate, John (University of Manitoba)
Bauer, Michael (University of Western Ontario)
Bhavsar, Virendra (University of New Brunswick)
Boutilier, Craig (University of Toronto)
Butz, Cory (University of Regina)
Cercone, Nicholas (Dalhousie University)
Chau, Siu-Cheung (Wilfred Laurier University)
Chiasson, Julien (Université de Moncton)
Cribb, Peter (York University)
Delgrande, James (Simon Fraser University)
Farmer, William (McMaster University)
Greer, Jim (University of Saskatchewan)
Hackborn, Bill (Augustana University of Alberta)
Haque, Waqar (University of Northern British Columbia)
Holzmann, Wolf (University of Lethbridge)
Howe, Douglas (Carleton University)
Hughes, David (Brock University)
Hurley, Richard T. (Trent University)
Lam, Clement (Concordia University)
Lavoie, Luc (Université de Sherbrooke)
Lethbridge, Timothy (University of Ottawa)

Lingras, Pawan (Saint Mary's University)
Martin, Pat (Queens University)
McCalla, Gord (University of Saskatchewan)
Meunier, Jean (Université de Montréal)
Mineau, Guy (Université Laval)
Mukopadhyay, Asish (University of Windsor)
Obaid, Abdel (University of Quebec at Montreal)
Radue, Jon (Brock University)
Schaeffer, Jonathan (University of Alberta)
Sutcliffe, Rick (Trinity Western University)
Therien, Denis (McGill University)
Villemure, Serge (NSERC)
Wong, Johnny (University of Waterloo)
Zastre, Michael (University of Victoria)

Cascade Topology Seminar Meeting Spring 2005
July 14–16, 2005

Organizers:

George Peschke (University of Alberta)
Laura Scull (University of British Columbia)

This workshop was a meeting of the Cascade Topology Seminar. This is a semi-annual gathering of the region's topologists which began in 1987, overseen by Steve Bleiler (Portland State University) and Dale Rolfsen (UBC). It is designed to foster contacts between workers, as well as graduate students, in similar fields across the region. It provides a venue for local topologists to showcase their own work, and also an opportunity to bring in speakers from outside the region, helping local topologists to keep abreast of recent developments.

In all these respects, the BIRS meeting of the Cascade Topology Seminar was a great success. This meeting had 25 participants from various schools in western Canada and the Pacific Northwestern US; a few participants also came from the east (Ontario and the midwestern US). The group included established researchers, early career mathematicians and quite a few graduate students from various schools.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2612/

Participants:

Beyl, Rudolf (Portland State University)
Bleiler, Steve (Portland State University)
Budney, Ryan (University of Oregon)
Cohen, Ralph (Stanford University)
Devinatz, Ethan (University of Washington)
Dolan, Peter (University of Oregon)
Dover, Lynn (University of Alberta)
Elmendorf, Anthony (Purdue University Calumet)
Grguric, Izak (UBC)
Krause, Eva (University of Alberta)
Lam, Kee (UBC)
Lockridge, Keir (University of Washington)
Morris, Dave Witte (University of Lethbridge)
Nicas, Andrew (McMaster University)
Palmieri, John (University of Washington)
Peschke, George (University of Alberta)
Prince, Tom (University of Alberta)
Rodriguez Ordonez, Hugo (University of Oregon)
Ruan, Haibo (University of Alberta)
Scull, Laura (UBC)
Tomoda, Satoshi (University of Calgary)
Varadarajan, Kalathoor (University of Calgary)
von Bergmann, Jens (University of Calgary)
Yurasovskaya, Ekaterina (UBC)
Zvengrowski, Peter (University of Calgary)

Connecting Women in Mathematics Across Canada II
July 21–23, 2005

Organizers:

Gerda de Vries (University of Alberta)
Malgorzata Dubiel (Simon Fraser University)
Rachel Kuske (University of British Columbia)
Judi McDonald (Washington State University)

This workshop was designed to continue the work started by the very successful CWiMAC conference for women graduate students in the mathematical sciences, which took place June 12 - 13th, 2003, at the University of Alberta in Edmonton. It would be an integral part of developing a mentoring network to help young women interested in pursuing research in the mathematical sciences, by giving them opportunity to meet women mathematicians working at Canadian and US universities. Participants also had the opportunity to present their research to a peer group, as well as learn various career strategies: how do present a paper, how to organize their research goals, etc. They met other women graduate students from across Canada and from the Washington State, and share their experiences.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2010/

Participants:

Beltaos, Elaine (University of Alberta)
Burgess, Andrea (Memorial University of Newfoundland)
Cooper, Sandy (Washington State University)
Dawes, Adriana (UBC)
Dewar, Megan (Carleton University)
Dubiel, Malgorzata (SFU)
Eftimie, Raluca (University of Alberta)
Farnesi, Claudia (Concordia University)
Farzamirad, Meymanat (University of Alberta)
Keshet, Leah (UBC)
Keyfitz, Barbara Lee (Fields/ University of Houston)
Kuske, Rachel (UBC)
Lamkin, DeAnne (Washington State University)
Legendre, Eveline (University of Montreal)
Leite, Maria (University of Houston)
Li, Qun (McGill University)
Lisawadi, Spranee (University of Regina)
Lushi, Enkeleida (SFU)
Masuda, Ariane (Carleton University)
McDonald, Jessica (University of Waterloo)
McDonald, Judi (Washington State University)
Meagher, Karen (University of Ottawa)
Mishna, Marni (SFU)
Oellermann, Ortrud (University of Winnipeg)
Pandey, Pooja (University of New Brunswick)
Pronk, Dorette (Dalhousie University)
Ring, Amy (Washington State University)
Romaniuk, Yulia (University of Alberta)
Ruan, Haibo (University of Alberta)
Sanscartier, Manon (University of Saskatchewan)
Scull, Laura (UBC)
St-Hilaire, Marie-Odette (Université de Montréal)
Thandi, Neeza (Liberty Mutual Group)
Verdian-Rizi, Maryam (SFU)
Yu, Na (UBC)

West Coast Operator Algebras Seminar 2005
September 15–17, 2005

Organizers:

Anthony To-Ming Lau (University of Alberta)
Volker Runde (University of Alberta)

The West Coast Operator Algebras Seminar is a series of conferences that started in 1991 and has since then been held on a yearly basis at various venues along the North American West Coast - in particular as a 2-day workshop at BIRS in 2003 -, and has provided a forum for researchers - young ones in particular - to present

their results and exchange ideas with likeminded people. It has been remarkably successful in bringing together researchers that are scattered over a vast geographical area and otherwise have little opportunity to interact. The purpose of this workshop was to carry on this tradition. Enough time between and after talks for discussion among participants were planned and preference was given to junior researchers in the area when it came to scheduling talks.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2610/

Participants:

Argerami, Martin (University of Regina)
Ashley, Dawn (University of Oregon)
Blackadar, Bruce (University of Nevada, Reno)
Blecher, David (University of Houston)
Brenken, Berndt (University of Calgary)
Deaconu, Valentin (University of Nevada at Reno)
Della Roca, Giulio (California State University-Long Beach)
Effros, Edward (UCLA)
Elliott, George (University of Toronto)
Erlijman, Juliana (University of Regina)
Farenick, Douglas (University of Regina)
Floricel, Remus (UC-Berkeley)
Goodearl, Ken (UC-Santa Barbara)
Ivanescu, Cristian (UNBC)
Kaliszewski, Steve (Arizona State University)
Kumjian, Alex (University of Nevada, Reno)
Laca, Marcelo (University of Victoria)
Lamoureux, Michael (University of Calgary)
Lau, Anthony To-Ming (University of Alberta)
Matui, Hiroki (Chiba University)
Nikolaev, Igor (University of Calgary)
Phillips, N. Christopher (University of Oregon)
Phillips, John (University of Victoria)
Pollock, Dan (University of Victoria)
Putnam, Ian (University of Victoria)
Quigg, John (Arizona State University)
Runde, Volker (University of Alberta)
Sherman, David (UC-Santa Barbara)
Sourour, Ahmed Ramzi (University of Victoria)
Uygul, Faruk (University of Alberta)
Whittaker, Michael (University of Victoria)

Alberta Postsecondary Curriculum Conference II
September 29–October 1, 2005

Organizers:

Jack Macki (University of Alberta)

This conference built on the work done since the first meeting in October, 2004, and the interim reports given at the Alberta North-South meeting in May, 2005. Ongoing plans for curriculum revision and development of a core curriculum for Alberta Colleges and Universities were reported at this meeting, focusing primarily on Analysis in the first two years.

The objective was to get to the stage of actually proposing moderate to radical changes in the mathematics being taught in the first two years of university, focusing on students who are not majoring in physics, math or engineering. The idea is to develop a firm curriculum and a careful program for limited introduction with extensive evaluation.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2613/

Participants:

Akbary, Amir (University of Lethbridge)
Allegretto, Walter (University of Alberta)
Bailey, Jim (College of the Rockies)
Cliff, Gerald (University of Alberta)
De Young, Gary (Kings College)
Dinh, Thi (University of Calgary)
Dmitrasinovic-Vidovic, Gordana (Mount Royal College)
Estabrooks, Manny (Red Deer College)
Freed, Bill (Concordia University College)
Ganta, Reddy (Grand Prairie Regional College)
Girvan, Doug (Red Deer College)
Guelzow, Andreas (Concordia University College of Alberta)
Hackborn, Bill (Augustana Faculty)
Hohn, Tiina (Grant MacEwan College)
Holloway, Thomas
Holzmann, Wolfgang (University of Lethbridge)
Kaip, Thomas (Grande Prairie Regional College)
Kharaghani, Hadi (University of Lethbridge)
Kudryavtseva, Elena (University of Calgary/ Moscow State University)
LaHaye, Roberta (Mount Royal)
Ling, Joseph (University of Calgary)
Macki, Jack (University of Alberta)
McLaughlin, David (Grant MacEwan College)
Pivovarov, Peter (University of Alberta)
Roberts, Malcolm (University of Alberta)
Stastna, Viena (University of Calgary)
Stellmach, Joan (University of Calgary)
Svishchuk, Mariya (Mount Royal College)
Thangarajah, Pamini (Mount Royal College)
Timourian, Jim (University of Alberta)
Tomoda, Satoshi (Mount Royal College)
Zvengrowski, Peter (University of Calgary)

Pacific Rim Mathematical Forum
October 13–16, 2005

Organizers:

Alejandro Adem (University of British Columbia)
David Eisenbud (Mathematical Sciences Research Institute/UC-Berkeley)
Ivar Ekeland (Pacific Institute for the Mathematical Sciences)

The main objective of this meeting was to form a cohesive network of mathematical centers in the Pacific Rim, with the goal of laying the groundwork for substantial networking activities.

During this meeting a number of activities were organized, including mathematical presentations, roundtables and wide ranging discussions. Our goal was to exchange points of view and information in order to develop a blueprint for comprehensive interactions between Pacific Rim mathematicians. For example, we might consider sponsoring a network of summer schools that would be widely advertised, and accept participants from the different mathematical institutions around the Pacific Rim. Another possible idea would be to develop international collaborative research groups, involving exchanges of scholars, postdocs and graduate students.

This event is organized jointly by MSRI and PIMS.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2614/

Participants:

Adem, Alejandro (UBC)
Archibald, Tom (SFU)
Axler, Sheldon (San Francisco State University)
Chen, Louis (National University of Singapore)
Cheng, Shiu-Yuen (Hong Kong University of Science and Technology)
Conder, Marston (University of Auckland)
Conrey, Brian (American Institute of Mathematics)
Cowling, Michael (University of New South Wales)
de la Pena, Jose Antonio (UNAM, Mexico)
Driver, Bruce (UC-San Diego)
Eisenbud, David (MSRI/ UCBerkeley)
Ekeland, Ivar (PIMS)
Eliashberg, Yakov (Stanford University)
Ghoussoub, Nassif (UBC)
Gitler, Isidoro (Centro de Investigación y de Estudios)
Gupta, Arvind (Simon Fraser University)
Guttmann, Tony (University of Melbourne)
Han, Chong-Kyu (Seoul National University)
Jin, Shi (University of Wisconsin-Madison)
Katsura, Toshiyuki (University of Tokyo)
Keum, Jong Hae (Korean Institute for Advanced Study)
Kim, Dohan (Seoul National University)
Kuske, Rachel (UBC)
Lau, Anthony To-Ming (University of Alberta)
Lind, Douglas (University of Washington)
Long, Yiming (Nankai University)
Montenegro, Carlos (Universidad de Los Andes)
Mukai, Shigeru (Kyoto University)
Mulase, Motohico (UC-Davis)
Quas, Anthony (University of Victoria)
Russell, Brian (University of Calgary)
Tian, Gang (Princeton University)
Zhang, Gong Qing (Peking University)

The Kneser-Poulsen Conjecture
November 3–5, 2005

Organizers:

Karoly Bezdek (University of Calgary)
Robert Connelly (Cornell University)

Due to recent developments we had high hopes that the status of the longstanding conjecture of M. Kneser (1955) and E. T. Poulsen (1954) - one of the best known conjectures of discrete geometry - would soon change dramatically and would provide more insight to the geometry of spaces of constant curvature. It would be useful to have a forum to bring together people who had worked on the problem and had not had a chance so far to exchange their ideas in an intense way.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05w2057/

Participants:

Belk, Maria (Texas A&M University)
Bern, Marshall (Palo Alto Research Center)
Bezdek, Karoly (University of Calgary)
Brudnyi, Alex (University of Calgary)
Connelly, Robert (Cornell University)
Csikos, Balazs (Eotvos University, Institute of Mathematics)
Kiss, Gyorgy (Eotvos University)
Langi, Zsolt (University of Calgary)
Ling, Joseph (University of Calgary)

Banff International Research Station

2005

Summer Schools

Research In Teams

Focused Research Groups

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

Organizers:

Siwan Anderson (University of British Columbia)
Esther Duflo (Massachusetts Institute of Technology)
Sendhil Mullainathan (Harvard University)

A range of methodological approaches characterizes development economics. The BREAD (Bureau for Research and Economic Analysis of Development) Summer School is aimed at exposing students, in the formative periods of their research careers, to theoretical and econometric techniques outside that which they are exposed to in their home institutions. This expands and enriches their research capabilities and helps them break into new areas that may not have previously been on their research horizons. Deepening and broadening technical skills is an integral objective of the BREAD Summer School and is a key element of the formation of the students involved.

For details, please refer to the report online: http://www.pims.math.ca/birs/workshops/2005/05ss100/

Participants:

Adelman, Sarah (University of Maryland)
Anagol, Santosh (Yale University)
Anderson, Siwan (UBC)
Antman, Francisca (Stanford University)
Atanassova, Antonia (Harvard University)
Banerjee, Abhijit (MIT)
Barrington-Leigh, Chris (UBC)
Bennett, Dan (Brown University)
Berg, Erlend (London School of Economics)
Bidner, Chris (UBC)
Bjorkman, Martina (IIES, Stockholm University)
Bruhn, Miriam (MIT)
Burgess, Robin (London School of Economics)
Buteau, Sharon (Groupe d'Analyse)
Donaldson, Dave (London School of Economics)
Duflo, Esther (MIT)
Foster, Andrew (Brown University)
Goetghebuer, Tatiana (University of Namur)
Greig, Fiona (Harvard University)
Jakiela, Pamela (UC-Berkeley)
Kendall, Alexander (MIT)
Kremer, Michael (Harvard University)
Ku, Hyejin (Cornell University)
Lafortune, Jeanne (MIT)
Lehrer, Kim (UBC)
Leino, Jessica (UC-Berkeley)
Lorentzen, Peter (Stanford University)
Mani, Subha (University of Southern California)
Martinez, Claudia (University of Michigan)
Mbiti, Isaac (Brown University)
Mookherjee, Dilip (Boston University)
Mullainathan, Sendhil (Harvard University)
Nagavarapu, Sriniketh (Stanford University)
Pande, Rohini (Yale University)
Paul, Sourabh Bikas (UBC)
Paul, Sohini (Indira Gandhi institute)
Puentes, Esteban (University of Chicago)
Schlosser, Analia (Hebrew University of Jerusalem)
Schnabl, Philipp (Harvard University)
Shemyakina, Olga (University of Southern California)
Tenikue, Michel (University of Namur)
Thomas, Duncan (UCLA)
Williams, Heidi (Harvard University)
Wilson, Nicholas (Brown University)
Zakirova, Rezida (Boston University)

2005 Summer IMO Training Camp
June 28–July 9, 2005

Organizers:

Bill Sands (University of Calgary)

The purpose of the IMO (International Math Olympiad) Training Camp was to be an intensive two-week preparation for the six Canadian students attending the upcoming IMO, and also to allow these students to get to know each other well. The location of the IMO Camp is dependent on the location of the IMO, as the students go directly to the IMO from the Camp, and we therefore like to hold the Camp as close to the IMO site as possible. In 2005 the IMO was in Mexico, so BIRS would to be an appropriate site for the 2005 Camp. Canada won one gold, two silver and two bronze medals in Mexico. The 2003 Summer IMO Training Camp was also held at BIRS. The IMO Team in 2003 had two Gold Medals and three Bronze Medals.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05ss006/

Participants:

Braverman, Elena (University of Calgary)
Fei, Lin (Don Mills Collegiate Institute)
Grant, Elyot (IMO Team Member)
Liu, Andy (University of Alberta)
Ottaway, Paul (Dalhousie University)
Peng, Richard (2005 Summer IMO Training Camp)
Pronk, Dorette (Dalhousie University)
Recio, Felix (University of Toronto)
Rhee, David (Mcnally High School)
Sands, Bill (University of Calgary)
Shi, Peng (Sir John A. Macdonald C.I.)
Tang, Adrian (University of Calgary)
Zhao, Yufei (Don Mills Collegiate Institute)

Computing the Continuous Discretely: Integer-Point Enumeration in Polyhedra
August 6–20, 2005

Organizers:

Matthias Beck (San Francisco State University)
Sinai Robins (Temple University)
Hugo Rossi (Mathematical Sciences Research Institute)

The objective of the summer school was to introduce students to a vital area of mathematics which exemplifies the interaction between different mathematical subjects, as well as the interaction between theoretical and computational aspects of mathematics. Participants experienced a deeper understanding of the wide range of mathematical fields and how they connect, and they would get first-hand experience of the excitement and challenges that are lurking behind computational experiments.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05ss027/

Participants:

Arnondin, Jeanne (Tulane University)
Beck, Matthias (San Francisco State University)
Bendich, Paul (Duke University)
Berglund, Nathanael (Georgia Institute of Technology)
Bogart, Tristram (University of Washington)
Braun, Benjamin (Washington University, St. Louis)
Byrnes, Patrick (University of Minnesota)
Camenga, Kristin (Cornell University)
Campbell, Ellen (Washington University in St. Louis)
Duong, Han (University of Illinois, Urbana-Campaign)
Genoway, Sarah (Rutgers University)
Howard, Benjamin (University of Maryland)
Leung, Desmond (Simon Fraser University)
Luoto, Kurt (University of Washington)
Maciak, Piotr (Louisiana State University)
Manna, Dante (Tulane University)
Mason, Sarah (University of Pennsylvania)
McAllister, Tyrrell (University of California, Davis)
McAvoy, Tom (North Carolina State University)
Medina, Luis (Tulane University)
Minnes, Mia (Cornell University)
Moorefield, Dorothy (San Francisco State University)
Mukherjee, Debabrata (University of North Carolina at Chapel Hill)
Nicolas, Carlos (University of Kentucky)
Pagano, Gino (Temple University)
Price, Candice (San Francisco State University)
Robins, Sinai (Temple University)
Santoyo, Miguel (Instituto de Matematicas, Unidad Morelia, Universidad Nacional Autonoma de Mexico)
Silva, Manuel (City University of New York)
Simmons, Melissa (University of Illinois-Urbana Campaign)
Sookdeo, Vijay (University of Rochester)
Veomett, Ellen (University of Michigan)
Wang, Miranda (San Francisco State University)
Woods, Kevin (UC-Berkeley)

Research in Teams

Speciality of Malcev Algebras
April 30–May 14, 2005

Organizers:

Murray Bremner (University of Saskatchewan)
Irvin Hentzel (Iowa State University, Ames, IA)

The most important open question is whether every Malcev algebra is special: can every anticommutative algebra satisfying the Malcev identity be realized as a subspace of some alternative algebra which is closed under the commutator? There are many other open problems in this area: (1) to find special identities for Malcev algebras (identities satisfied by all special Malcev algebras but not by all Malcev algebras); (2) to show that any homomorphic image of a special Malcev algebra is again special; (3) to classify absolute zero divisors in free Malcev algebras (recently we discovered new elements in the radical of free alternative algebras: J. Symbolic Computation 33 (2002) 255-273); and (4) to construct enveloping alternative algebras for Malcev algebras (important recent work on this last question has been done by I.P. Shestakov and J.M. Perez-Izquierdo). This RIT group planned to develop computational and theoretical methods to attack these problems.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05rit020/

Participants:

Bremner, Murray (University of Saskatchewan)
Hentzel, Irvin (Iowa State University, Ames, IA)
Peresi, Luiz (Universidade de Sao Paulo)

Random Matrices, Multi-Orthogonal Polynomials and Riemann-Hilbert Problems
April 30–May 14, 2005

Organizers:

John Harnad (University of Montreal and Concordia University)

The objective of this collaborative project was to further advance the computation of large N asymptotics in multimatrix models, building on the earlier results for 1-matrix models and the Riemannn-Hilbert problem setting for multi-orthogonal polynomials developed previously.
Objectives included:
1) to relate the "dual" formulations of the R-H problem characterizing biorthogonal polynomials obtained by the different members of this group. 2) to extend the asymptotic methods - including the "nonlinear WKB" approach, based on the RH method, as well as variational methods, based on Coulomb gas dynamics, to obtain rigorous large N asymptotics for biorthogonal polynomials and the associated "Christoffel-Darboux" kernels, whose determinants give the multi-matrix model correlation functions of interest.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05rit094/

Participants:

Bertola, Marco (Concordia University)
Eynard, Betrand (SPhT CEA Saclay)
Harnad, John (University of Montreal and Concordia University)
McLaughlin, Ken (University of Arizona)

Affinizations of Extended Affine Lie Algebras
May 21–June 4, 2005

Organizers/ Participants:

Bruce Allison (University of Alberta)
Stephan Berman (University of Saskatchewan)
Arturo Pianzola (University of Alberta)

This project studies loop algebras and affinizations of Lie algebras relative to finite period automorphisms, and their role in the construction of extended affine Lie algebras (EALA's). The aim was to put Kac's work relating the finite dimensional simple Lie algebras with the affine Kac-Moody Lie algebras, mentioned earlier in the overview, in a natural and very broad context. The group also wished to study the finer structure of these affinizations including their coordinate algebras and the central closures of their centreless cores. The detailed study provided a base of examples for further study of the EALA's of higher nullity that arise as affinizations. The Banff International Research Station provided an ideal place for the three researchers to get together for two weeks of uninterrupted research.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05rit024/

Hamiltonian Systems with Symmetry
August 20–27, 2005

Organizers:

George Patrick (University of Saskatchewan)

In this workshop, a team of three participants interacted very intensely. Progress was made on the isotropy project, and priorities sorted and possibilities found for further collaboration. A stalled project (the axisymmetric stability project) was reinvigorated, and work which would have taken many months, if it could have been completed at all, was largely completed in one week, with a far superior outcome. Partly this was due to an extensive preparation for the workshop, following an initial consultation a year earlier at the Bernoulli Institute of EPFL Switzerland. The team is scattered across Canada and the UK, but the BIRS Research in Teams program enabled it to meet, concentrate on, and in large part resolve, a difficult problem, and to prepare the way for future collaborations.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05rit606/

Participants:

Patrick, George (University of Saskatchewan)
Roberts, Mark (University of Surrey)
Wulff, Claudia (University of Surrey)

Cohomogeneity Three Actions on Spheres
August 21–September 3, 2005

Organizers/ Participants:

Jill McGowan (Howard University)
Catherine Searle (IMATE-UNAM Unidad Cuernavaca)

During our stay at BIRS, we were able to modify the original project of classifying cohomogeneity 3 actions on spheres to the following problem: calculate the diameters and q-extents of spherical quotients of irreducible polar actions of cohomgeneities 3 and higher.

While we modified our original proposal for our stay at BIRS, we have by no means abandoned the idea of classifying spherical actions of cohomogeneity 3 and higher. Upon conclusion of this current project, we hope to be able to tackle not only the classification problem, but also to understand how the diameters of spherical quotients of non-polar actions behave in terms of our conjecture.

In conclusion, we would like to add that we feel that our stay at BIRS was incredibly productive for us. This is the first time we have had an entire 2 weeks in which to just concentrate on our research. We are both very happy to have been provided with this opportunity.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05rit047/

Symmetries of Extremal Conformal Mappings
August 25–September 3, 2005

Organizers/ Participants:

Oliver Roth (University of Wuerzburg)
Eric Schippers (University of Manitoba)

A central problem in geometric function theory is to describe the class of conformal mappings of the disc. Two of the main reasons for the importance of this class are the Riemann mapping theorem, and the fact that it provides a model for the universal Teichmueller space. Solving extremal problems over the class (or developing methods for doing so) is one method of describing it, since the extremal function attaining the maximum must lie on the boundary.

In two approaches to solving extremal problems, the variational method of Schiffer and the extremal metric method of Teichmueller, the extremal functions are solutions of a differential equation given by a quadratic differential. This partly determines the extremal function, but it is still not known how in general to determine the function completely.

In some cases further symmetries of the extremal function can be identified from the functional, which appear in different forms in the Schiffer and Teichmueller approaches. Using work of Roth on a control-theoretic interpretation of Schiffer's method and work of Schippers on conformal metrics, we plan to investigate the relation between the appearance of symmetries in the two methods and the possibility of using them to solve extremal problems.

For details, please refer to the webpage:
http://www.pims.math.ca/birs/workshops/2005/05rit091/

Arithmetic applications of theta functions
October 1–15, 2005

Organizers/ Participants:

Christopher Skinner (University of Michigan)
Vinayak Vatsal (University of British Columbia)

We wish to consider two well-known problems in algebraic number theory from the viewpoint of theta functions. Both problems involve well-known conjectures in algebraic number theory about which little is known, and any progress in these directions would be significant.

1. A case of the Bloch-Kato conjecture. Consider an elliptic modular cuspform f of weight 2k >2. Let p denote an ordinary prime for f. Then Bloch and Kato have defined a p-adic Selmer group $S_{k+1}(f)$ associated to f, and the Bloch-Kato conjecture states that the order of the $S_{k+1}(f)$ is given by a suitable normalized value of the L-function $L(F,s)$ associated to f (at $s=k+1$).

2. A well-know problem in algebraic number theory asks whether a given elliptic curve E over $\boldsymbol{Q}$ and a prime p of good reduction for E, there exists a quadratic twist E_D of E whose Selmer group has order prime to p. The existence of such a twist was conjectured by Kolyvagin in the context of his work on the conjecture of Birch and Swinnerton-Dyer, and a proof of Kolyvagin's conjecture would indeed have significant applications to the Birch-Swinnerton-Dyer problem.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05rit609/

Analysis, Computations, and Experiments on Pinch-off in Liquid Jets
March 12–26, 2005

Organizers:

Huaxiong Huang (York University)
Robert Miura (New Jersey Institute of Technology)
Demetrius Papageorgiou (New Jersey Institute of Technology)

This Focussed Research Group brought together a critical mass of researchers to work on fundamental problems that involve the breakup of liquid jets and on fluid and fluid jet problems that are motivated by industrial applications. Recent theoretical advances in the understanding of the breakup of single fluid jets are ripe to translate the control of breakup of jets. We also used concrete mathematical models to investigate utilizing liquid jet phenomena in the manufacture of micro- and nano-scale structures. Significant work remains to be done in the modeling and analysis of jets with more complicated geometries (e.g., compound jets) and involving complex fluids, which are typically found in industrial applications.

The FRG included applied mathematicians involved in modeling and asymptotic analysis in fundamental problems (Papageorgiou, Siegel, Howell, Young) as well as more applied problems motivated by industrial applications (Huang, Miura, Wylie), and a physicist with expertise in modeling and numerical simulation (Zhang). Many of the program participants are internationally known for their contributions to interfacial fluid dynamics.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05frg060/

Participants:

Howell, Peter (University of Oxford)
Huang, Huaxiong (York University)
Miura, Robert (New Jersey Institute of Technology)
Papageorgiou, Demetrius (New Jersey Institute of Technology)
Siegel, Michael (New Jersey Institute of Technology)
Wylie, Jonathan (City University of Hong Kong)
Young, Yuan-Nan (New Jersey Institute of Technology)
Zhang, Wendy (University of Chicago)

The Local Index Theorem in Noncommutative Geometry
April 16–30, 2005

Organizers:

Nigel Higson (Pennsylvania State University)
John Phillips (University of Victoria)

Recently the organizers and their co-workers had found new proofs of the local index formula which have the potential to greatly widen the range of applications. In particular Phillips et al had found a proof which extends the theorem to the case of spectral triples associated to semifinite von Neumann algebras which for example, means the L^2-index theorem for covering spaces is also a consequence of this extended local index formula. The organizers had also discovered new formulae for cocycles in the (b,B) bicomplex which appear to also have the potential for other interesting applications. These new developments were very much in their early phases so that a meeting of the researchers who had made these discoveries would be very timely.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05frg603/

Participants:

Azamov, Nurulla (Flinders University)
Carey, Alan (Australian National University)
Higson, Nigel (Pennsylvania State University)
Phillips, John (University of Victoria)
Rennie, Adam (University of Newcastle)

Influenza Dynamics: Models and Data
May 28–June 11, 2005

Organizers:

Jonathan Dushoff (Princeton University)
David Earn (McMaster University)
Joshua Plotkin (Harvard University)

The recent workshop at BIRS offered us a fantastic opportunity for collaboration and focused, productive research. We used mathematical models to study the spread and evolution of influenza viruses. We attempted reconciliation of our models with empirical data on influenza epidemics; and to form collaboration with Christina Mills and Marc Lipsitch from the Harvard School of Public Health. Perhaps most important is the strong collaboration we have formed with the Mills/Lipsitch group, resulting in two completed manuscripts already.

The importance of developing and studying such analytical models would be hard to overstate. Influenza represents one of the most serious worldwide public health problems, causing an estimated 20,000 deaths per year in the United States alone. In addition, any new methods for robustly predicting influenza dynamics and for improving control strategies are likely to be useful in confronting other, emerging infectious diseases.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05frg084/

Participants:

Bauch, Chris (University of Guelph)
Dushoff, Jonathan (Princeton University)
Earn, David (McMaster University)
Ma, Junling (University of Victoria)
Mills, Christina (Harvard School of Public Health & Harvard Medical School)
Plotkin, Joshua (Harvard University)

Hyperplane Arrangements: Cohomology and Rational Homotopy
June 11–18, 2005

Organizers:

Graham Denham (University of Western Ontario)
Alexandru Suciu (Northeastern University)

The topics on Cohomology and Rational Homotopy were expected to receive considerable attention over the course of the MSRI Fall 2004 program Hyperplane Arrangements and Applications. The meeting was timed to help anticipated and existing colloborations to continue in the wake of the MSRI program. The focussed research group format was ideal here, since the topic was quite specific and many of the proposed participants have worked together before. One or two conferences in arrangement theory had taken place almost every year since 1991, in France, Germany, Japan, Switzerland, and the US. The meeting was the first of its kind to be held in Canada.

For details, please refer to the webpage:
http://www.pims.math.ca/birs/workshops/2005/05frg090/

Participants:

Cohen, Daniel (Louisiana State University)
Denham, Graham (University of Western Ontario)
Falk, Michael (Northern Arizona University)
Iyengar, Srikanth (University of Nebraska)
Schenck, Hal (Texas A&M University)
Suciu, Alexandru (Northeastern University)
Yuzvinsky, Sergey (University of Oregon)

Topological Methods for Aperiodic Tilings
July 16–30, 2005

Organizers:

Johannes Kellendonk (Universite Claude Bernard Lyon 1)
Ian Putnam (University of Victoria)
Lorenzo Sadun (University of Texas at Austin)

In the 1960's and 1970's, mathematicians discovered geometric patterns which displayed a high degree of regularity, and yet were not periodic. The subject also gained enormous importance with the discovery of physical materials (quasicrystals) with pure point x-ray diffraction spectrum, which indicates a highly ordered atomic structure, and yet symmetry patterns in that spectrum which could not be produced by periodic atomic structures. Since that time, the subject has grown substantially. In doing so, it has drawn on a highly diverse collection of mathematical ideas.

The main idea of the group was to bring together a wide range of expertise to focus of the structure of the cohomology and its interpretations. The areas included physics, topology, dynamical systems, operator algebras. The insights from each of these fields would be useful as tools for the study of aperiodic media.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05frg069/

Participants:

Barge, Marcy (Montana State University)
Bellissard, Jean (Georgia Institute of Technology)
Diamond, Beverly (College of Charleston)
Frank, Natalie Priebe (Vassar College)
Gambaudo, Jean-Marc (University de Bourgogne)
Giordano, Thierry (University of Ottawa)
Gähler, Franz (Universität of Stuttgart)
Hunton, John (University of Leicester)
Kalugin, Pavel (Université Paris-Sud)
Kellendonk, Johannes (Universite Claude Bernard Lyon 1)
Putnam, Ian (University of Victoria)
Radin, Charles (University of Texas, Austin)
Sadun, Lorenzo (University of Texas at Austin)
Williams, Robert (University of Texas)

Hyperbolic geometry and quasiconformal mappings
August 6–13, 2005

Organizers:

Petra Bonfert-Taylor (Wesleyan University)
Martin Bridgeman (Boston College)
Richard Canary (University of Michigan)
Gaven Martin (Massey University)
Richard Schwartz (University of Maryland)
Edward Taylor (Wesleyan University)

The interaction between hyperbolic geometry and conformal analysis is a beautiful and fruitful aspect of the fields of analysis and low-dimensional geometry-topology. In particular, the study of hyperbolic geometry intertwines complex analysis, geometric function theory (especially in the guise of the study of quasiconformal mappings), and topology in a way that allows one to study a fixed object from diverse perspectives.

Our specific interest in the interaction between analysis and hyperbolic geometry is in the many uses of quasiconformal mappings to study the geometry. The theory of quasiconformal mappings has proved to be foundational to the modern studies of geometric analysis and low dimensional topology and geometry.

We wished to assemble a broad and diverse working group in hyperbolic geometry and conformal analysis in order to review and extend the current state of knowledge in applications of quasiconformal mappings to hyperbolic geometry. We had specific examples of questions which we hoped to investigate during the meeting.

For details, please refer to the report online:
http://www.pims.math.ca/birs/workshops/2005/05frg502/

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