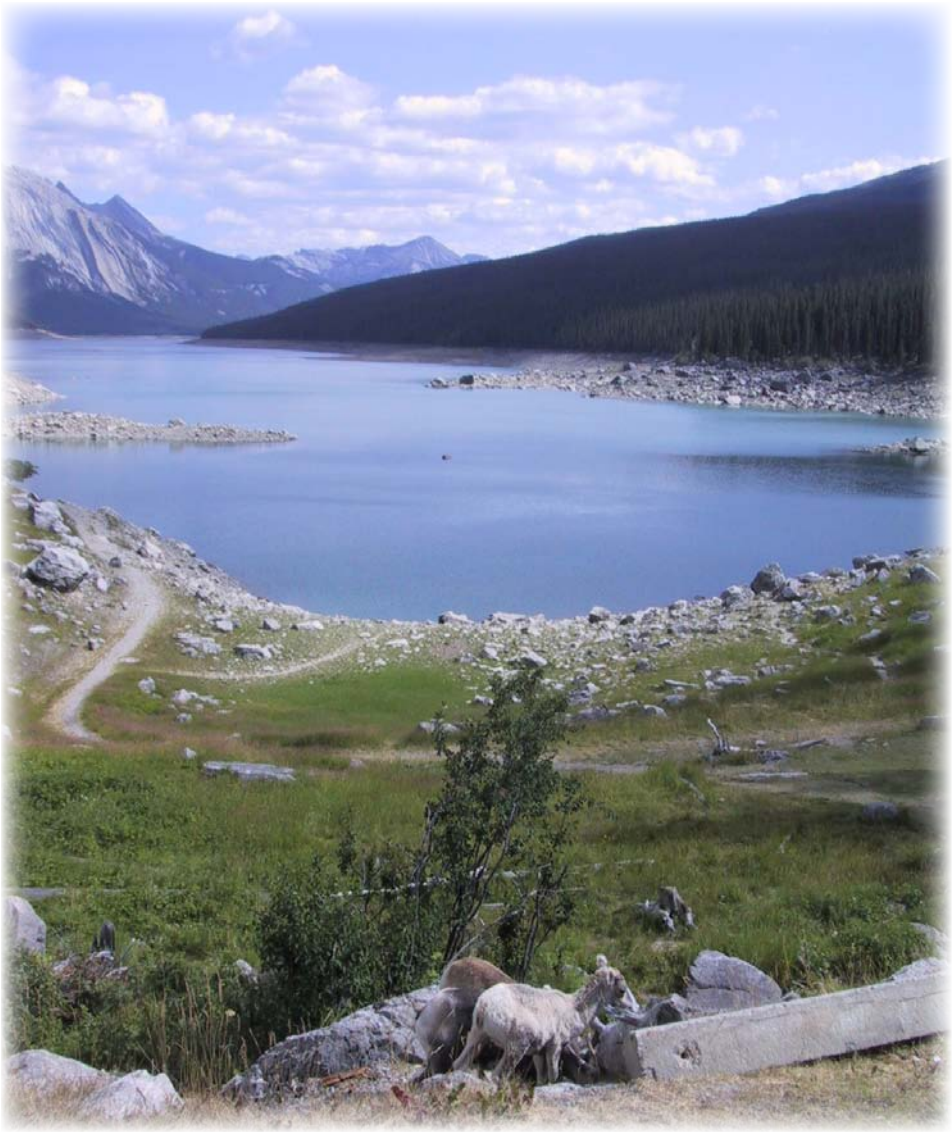
Banff International Research Station
for Mathematical Innovation and Discovery

BIRS 2006 Scientific Report



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Contents

Banff International Research Station

2006

5-Day Workshops

Frontiers in String Theory
February 11 - 16, 2006

Organizers:

Brian Greene (Columbia University)
Hirosi Ooguri (California Institute of Technology)
Amanda Peet (University of Toronto)
Gordon Semenoff (University of British Columbia)

Some of the most high powered theoretical physicists in the world converged at BIRS for a workshop on recent developments in superstring theory. This event was co-organized by Professor Brian Greene of Columbia University, who was also the author of the best-selling book and star of the PBS Nova program entitled "The Elegant Universe''. Other organizers were string theorists Hirosi Ooguri of Caltech, Amanda Peet and Gordon Semenoff from the Universities of Toronto and British Columbia. The workshop focused on the hottest new results in superstring theory which was a candidate for a unified theory of the fundamental constituents of matter and their interactions. It was touted as a solution of the long-standing problem of quantizing gravity and reconciling Einstein's general theory of relativity and the quantum theory. It had many profound consequences which, with the concerted efforts of hundreds of theoretical physicists and mathematicians worldwide, were slowly being unraveled.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5057/

Participants:

Aganagic, Mina (University of California, Berkeley)
Bousso, Raphael (University of California, Berkeley)
Brandenberger, Robert (McGill University)
Buchel, Alex (Perimeter Institute, University of Western Ontario)
Cachazo, Freddy (Perimeter Institute)
Cvetic, **Mirjam** (University of Pennsylvania)
Danielsson, Ulf (Uppsala University)
Denef, Frederik (Rutgers University)
Giddings, Steve (University of California, Santa Barbara)
Gomis, Jaume (Perimeter Institute)
Greene, Brian (Columbia University)
Gukov, Sergei (California Institute of Technology)
Judes, Simon (Columbia University)
Kaloper, Nemanja (University of California, Davis)
Kapustin, Anton (California Institute of Technology)
Karch, Andreas (University of Washington)
Kazakov, Vladimir (Ecole Normale Superieure, Paris)
Kostov, Ivan (Saclay)
Maloney, Alexander (Stanford/SLAC)
Matsuo, Yutaka (University of Tokyo)
Okuyama, Kazumi (UBC)
Ooguri, Hirosi (California Institute of Technology)
Ovrut, Burt (University of Pennsylvania)
Peet, Amanda (University of Toronto)
Sarangi, Saswat (Columbia University)
Saxena, Ashish (University of Toronto)
Semenoff, Gordon (UBC)
Serban, Didina (Service de Physique Theorique, Saclay)
Sethi, Savdeep (University of Chicago)
Shenker, Stephen (Stanford University)
Shiu, Gary (University of Wisconsin)
Silverstein, Eva (Stanford University)
Spradlin, Marcus (University of Michigan/ IAS)
Taylor, Washington (Massachusetts Institute of Technology)
van der Schaar, Jan Peter (Columbia University)
Van Raamsdonk, Mark (UBC)
Verlinde, Erik (University of Amsterdam)
Verlinde, Herman (Princeton University)
Weltman, Amanda (Columbia University)
Zarembo, Konstantin (Uppsala)

Advances in Computational Scattering
February 18 - 23, 2006

Organizers:

David Nicholls (University of Illinois at Chicago)
Nilima Nigam (McGill University)
Fernando Reitich (University of Minnesota)

Scattering is the study of the interaction of waves with obstacles. These obstacles could be anything from gratings, to tumors, to ships; the waves could be electromagnetic, elastic, or acoustic. Think of sound waves in an auditorium, or radar waves bouncing off airplanes. The study of scattering problems has a very long and illustrious history, but only a limited number of exterior scattering problems can be solved analytically. Nowadays, research on wave scattering has been dramatically enriched by the numerical modeling and simulations made possible by modern computers. About 40 of the most prominent and active mathematicians in the field of "computational scattering" participated in this BIRS workshop.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5065/

Participants:

Antoine, Xavier (Institut National Polytechnique de Lorraine)
Beauwens, Robert (Université Libre de Bruxelles)
Benamou, Jean-David (Rice University)
Binford, Tommy (Rice University)
Bonnet-Ben Dhia, Anne-Sophie (CNRS-ENSTA)
Boubendir, Yassine (University of Minnesota Twin Cities)
Bruno, Oscar (California Institute of Technology)
Buffa, Annalisa (Istituto di Matematica Applicata e Tecnologie Informatiche)
Cakoni, Fioralba (University of Delaware)
Chandler-Wilde, Simon (University of Reading)
Colton, David (University of Delaware)
Coyle, Joseph (Monmouth University)
Demkowicz, Leszek (University of Texas)
Dubois, Olivier (McGill University)
Ecevit, Fatih (Max Planck Institute for Mathematics in the Sciences - Leipzig)
Gemmrich, Simon (McGill University)
Hagstrom, Thomas (University of New Mexico)
Han, Young Ae (California Institute of Technology)
Hsiao, George (University of Delaware)
Kurtz, Jason (University of Texas at Austin)
Luneville, Eric (ENSTA)
Maischak, Matthias (Universitaet Hannover, Institut fuer Angewandte Mathematik)
Martin, Paul A. (Colorado School of Mines)
Monk, Peter (University of Delaware)
Nedelec, Jean-Claude (Ecole Polytechnique Paiseau)
Nicholls, David (University of Illinois at Chicago)
Nigam, Nilima (McGill University)
Phillips, Joel (McGill University)
Reitich, Fernando (University of Minnesota)
Sadov, Sergey (Memorial University of Newfoundland)
Shen, Jie (Purdue University)
Sifuentes, Josef (Rice University)
Steinbach, Olaf (Technische Universitaet Graz)
Tsynkov, Semyon (North Carolina State University)
Warburton, Timothy (Rice University)

Convex Sets and their Applications
March 4 - 9, 2006

Organizers:

Ted Bisztriczky (University of Calgary)
Paul Goodey (University of Oklahoma)
Peter Gritzmann (Technische Universität München)
Martin Henk (University of Magdeburg)
David Larman (UC London)

Analytic Convex Geometry was already practiced several millenia ago by the great Egyptian, Babylonian and Greek geometers. It deals with such fundamental topics as the intrinsic properties of convex sets (volume, surface area, curvature, etc.), with the nature of convexity in diverse topological settings and with the role of convexity in approximation and stochastics. Discrete Convex Geometry deals with the structure and complexity of objects such as finite point sets, polytopes and arrangements of n-dimensional convex bodies. The roots of Applied and Computational Convexity lie jointly in geometry, in mathematical programming and in computer science.

In the past twenty years, there has been a significant development and increase in the importance of Convex Geometry which have resulted in a large number of excellent young researchers developing the various branches (Discrete,Analytic and Applied) of the discipline. The BIRS workshop is focused on bringing together active researchers representing the various aspects of convexity, in order to initiate new collaborations and to foster awareness of the developments across the full breadth of his growing area.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5059/

Participants:

Aliev, Iskander (University of Edinburgh)
Bayer, Margaret (University of Kansas, Lawrence)
Bezdek, Karoly (University of Calgary)
Bisztriczky, Ted (University of Calgary)
Boroczky, Jr., Karoly (Alfréd Rényi Institute of Mathematics)
Brandenberg, Rene (Technische Universität München)
Bremner, David (University of New Brunswick)
De Loera, Jesus (University of California, Davis)
Ehrenborg, Richard (University of Kentucky)
Fodor, Ferenc (University of Szeged)
Garcia-Colin, Natalia (University College London)
Gronchi, Paolo (University of Florence)
Henk, Martin (University of Magdeburg)
Hernandez Cifre, Maria (de los Angeles Universidad de Murcia)
Jimenez, Carlos (University of Alberta)
Kiderlen, Markus (University of Aarhus)
Koldobsky, Alexander (University of Missouri, Columbia)
Langi, Zsolt (University of Calgary)
Larman, David (UC London)
Lee, Carl (University of Kentucky)
Ling, Joseph (University of Calgary)
Litvak, Alexander (University of Alberta)
Ludwig, Monika (TU Wien)
Morales, Efren (CIMAT Mexico)
Naszódi, Marton (University of Calgary)
Onn, Shmuel (Technion - Israel Institute of Technology)
Papez, Peter (University of Calgary)
Peri, Carla (University Cattolica Milan)
Schneider, Rolf (University of Freiburg)
Schütt, Carsten (U.Kiel)
Sojka, Grzesgorz (Warsaw University of Technology)
Soltan, Valeriu (George Mason University)
Solymosi, Jozsef (UBC)
Stancu, Alina (Polytechnic University of NY/ UMass Lowell)
Swanepoel, Konrad (University of South Africa)
Vershynin, Roman (University of California, Davis)
Weil, Wolfgang (Universitaet Karlsruhe)
Werner, Elisabeth (Case Western Reserve University)
Wills, Joerg (TU Siegen)

Coarsely Quantized Redundant Representations of Signals
March 11 - 16, 2006

Organizers:

Sinan Gunturk (Courant Institute of Mathematical Sciences) **Alex Powell** (Vanderbilt University)
Thao Nguyen (City College, CUNY) **Ozgur Yilmaz** (University of British Columbia)

Digital computers and their efficiency on processing data is one of the main driving forces behind much of our modern technology. Not surprisingly, this places an ever increasing demand on providing accurate conversion between the real-world signals, such as audio, images, and video, and the digital world. This workshop at BIRS brought together expert mathematicians and engineers to discuss some of the latest advancements in the theory and practice of analog-to-digital conversion with special emphasis on applications in high-precision audio and image encoding. Among the participants are Prof. Ingrid Daubechies of Princeton University (member of the American National Academy of Sciences) and Prof. Jan Allebach of Purdue University who are world renowned experts in their respective fields in mathematics and engineering. Progress in the areas covered in this workshop could have far reaching consequences in digital audio applications as well as the technology behind digital cameras and printers.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5078/

Participants:

Allebach, Jan (Purdue University)
Benedetto, John (University of Maryland)
Bodmann, Bernhard (University of Waterloo)
Boelcskei, Helmut (Swiss Federal Institute of Technology (ETHZ))
Casazza, Peter (University of Missouri)
Daubechies, Ingrid (Princeton University)
DeVore, Ronald (University of South Carolina)
Doerr, Benjamin (Max-Planck-Institut fuer Informatik)
Fickus, Matthew (Air Force Institute of Technology)
Goyal, Vivek (Massachusetts Institute of Technology)
Gunturk, Sinan (Courant Institute of Mathematical Sciences)
Han, Bin (University of Alberta)
Jimenez, David (Georgia Institute of Technology)
Keller, Yosi (Yale University)
Krahmer, Felix (Courant Institute)
Kutyniok, Gitta (Princeton University)
Lammers, Mark (University of North Carolina, Wilmington)
Li, Shidong (San Francisco State University)
Nguyen, Thao (City College, CUNY)
Nowicki, Tomasz (IBM Research)
Paulsen, Vern (University of Houston)
Powell, Alex (Vanderbilt University)
Rauhut, Holger (University of Vienna)
Tanner, Jared (University of Utah)
Vaishampayan, Vinay (AT&T Shannon Labs)
Wang, Yang (Georgia Institute of Technology)
Weber, Eric (Iowa State University)
Wu, Chai Wah (IBM Thomas J. Watson Research Center)
Yedlin, Matt (UBC)
Yilmaz, Ozgur (UBC)
Zeng, Sidong (City College, CUNY)

Reaction-diffusion and Free Boundary Problem
March 18 - 23, 2006

Organizers:

Peter Constantin (University of Chicago)
François Hamel (Université Aix-Marseille III)
Robert Jerrard (University of Toronto)
Jean-Michel Roquejoffre (Université Paul Sabatier Toulouse III)
Lenya Ryzhik (University of Chicago)

Reaction-diffusion equations model problems arising in almost every branch of engineering, life, and social sciences. In combustion theory, they describe flame propagation with great accuracy, which is crucial in every experimental or industrial device involving a burning process. In theoretical physics, they are a precious tool to analyse superconducting materials. In epidemiology, they can predict how fast an infectious disease is likely to spread. In the social sciences, they describe some features of the spreading of rumors. They also impact other branches of mathematics such as E. de Giorgi's problem on minimal surfaces. This problem is now solved, after more than 20 years of efforts by a large community of mathematicians many of whom attended this workshop at BIRS.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5045/

Participants:

Aftalion, Amandine (Université Paris 6-UPMC)
Berestycki, Henri (EHESS)
Brauner, Claude-Michel (Université Bordeaux 1)
Cabré, Xavier (ICREA and Universitat Politecnica de Catalunya)
Constantin, Peter (University of Chicago)
Coville, Jérôme (CMM-Universidad de Chile)
Doelman, Arjen (Center for Mathematics and Computer Science)
Domelevo, Komla (Université Paul Sabatier Toulouse III)
Freidlin, Mark (University of Maryland)
Ghoussoub, Nassif (Banff International Research Station/ UBC)
Gordon, Peter (New Jersey Institute of Technology)
Gui, Changfeng (University of Connecticut)
Guo, Jong-Shenq (National Taiwan Normal University)
Hamel, François (Université Aix-Marseille III)
Haragus, Mariana (Université de Franche-Comté)
Jerrard, Robert (University of Toronto)
Kiselev, Alexander (University of Wisconsin, Madison)
Kosygina, Elena (Baruch College CUNY)
Lewicka, Marta (University of Minnesota)
Luckhaus, Stephan (University of Leipzig)
Matano, Hiroshi (University of Tokyo)
Mellet, Antoine (UBC)
Nakamura, Ken-Ichi (University of Electro-Communications Tokyo)
Nolen, James (University of Texas)
Novikov, Alexei (Pennsylvania State University)
Owhadi, Houman (California Institute of Technology)
Polacik, Peter (University of Minnesota)
Quastel, Jeremy (University of Toronto)
Roquejoffre, Jean-Michel (Université Paul Sabatier Toulouse III)
Rossi, Luca (University of Roma I)
Ryzhik, Lenya (University of Chicago)
Savin, Ovidiu (University of California, Berkeley)
Serfaty, Sylvia (Courant Institute of Mathematical Sciences, NYU)
Soner, H. Mete (Koc University)
Souganidis, Panagiotis (University of Texas, Austin)
Stevens, Angela (Max Planck Institute for Mathematics in the Sciences)
Ward, Michael (UBC)
Zlatos, Andrej (University of Wisconsin, Madison)

Exploring the Frontiers of Dynamic Nuclear Medicine Imaging for Medical and Molecular Applications
March 25 - 30, 2006

Organizers:

Anna Celler (University of British Columbia/ Vancouver Coastal Health Research Institute)
Grant Gullberg (E.O. Lawrence Berkelely Nat'l Lab)
Michael King (University of Massachusetts Medical School)
Manfred Trummer (Simon Fraser University)

Medical imaging provides physicians with diagnostically meaningful information about the anatomy and/or physiology of the patient. Advances in medical imaging rely upon improvements in hardware as well as on the development of new computational techniques and algorithms, involving research in physics, mathematics, computer science and engineering. This multidisciplinary workshop brought together top researchers in those disciplines with their medical colleagues to discuss recent advances in medical imaging techniques, focusing on dynamic methods. Standard methods of image creation require the studied object not to change during the time of data acquisition. For this reason most clinical imaging studies investigate and visualize only static tissue densities or tracer distributions. Yet, living organisms are not static: Better information about their function, normal or altered by disease, can be obtained by dynamic imaging methods.

Workshop participants were active in the development of methods to maximize the diagnostic information that can be obtained from medical imaging techniques by optimizing all stages of the imaging process. Practical benefits include better diagnostic tools for study and treatment of illnesses and cost reductions for certain clinical trials.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5049/

Participants:

Barrett, Harrison (University of Arizona)
Botterweck, Henrik (Philips Technology Research Laboratories Aachen)
Brill, Randy (Vanderbilt University)
Byrne, Charley (University of Massachusetts, Lowell)
Carson, Richard (Yale University)
Celler, Anna (UBC/Vancouver Coastal Health Research Institute)
Chan, Tony (National Science Foundation)
Cohen, Philip (Lions Gate Hospital)
Esquerre, Jean-Paul (CHU Purpan-Toulouse)
Farncombe, Troy (Nuclear Medicine Hamilton Health Science)
Gui, Changfeng (University of Connecticut)
Gullberg, Grant (E.O. Lawrence Berkelely Nat'l Lab)
Hafeli, Urs (UBC)
Hamarneh, Ghassan (SFU)
Huesman, Ronald H (Lawrence Berkeley National Lab, University of California)
Hugg, James (GE Global Research)
Hutton, Brian (University College London)
Kadrmas, Dan (University of Utah)
King, Michael (University of Massachusetts Medical School)
Marechal, Pierre (Universite Paul Sabatier Toulouse)
Möller, Torsten (SFU)
Qranfal, Joe (SFU)
Reutter, Bryan (Lawrence Berkeley National Laboratory)
Ruuth, Steven (SFU)
Scherzer, Otmar (University Innsbruck)
Shcherbinin, Sergey (UBC)
Sitek, Arkadiusz (E.O. Lawrence Berkeley National Laboratory)
Tanoh, Germain (IRMACS, SFU)
Toennies, Klaus (Fakultaet fuer Informatik Otto-von-Guericke Universitaet)
Trummer, Manfred (SFU)
Tsui, Benjamin (Johns Hopkins University)
Verhaeghe, Jeroen (Ghent University)
Vija, A. Hans (Siemens - Company representative)
Wells, Glenn (Lawson Health Research Institute)
Wen, Lingfeng (Royal Prince Alfred Hospital, Australia)
Yang, Yongyi (Illinois Institute of Technology - Biomedical Engineering)

Recent Trends in Higher Dimensional Geometry
April 1 - 6, 2006

Organizers:

Xi Chen (University of Alberta)
Alessio Corti (University of Cambridge)
Colin Ingalls (University of New Brunswick)
Sandor Kovacs (University of Washington)
James McKernan (University of California-Santa Barbara)
Miles Reid (University of Warwick)

The two objectives of the workshop were 1. to bring together groups of people working in the closely related areas mentioned in A, B, C and D below, to promote collaboration between the top researchers in these areas; 2. to have a series of lectures on recent topics of common interest.

[A] Birational Classification of Algebraic Varieties; the minimal model program in dimension four and higher; classification of threefolds using the methods of Corti and Sarkisov; rigidity of Mori fibrations; derived categories and birational classification of Fano varieties and Calabi-Yau varieties. [B] Moduli spaces; existence of moduli spaces of surfaces and higher dimensions; moduli spaces of abelian varieties; the cone of curves of the moduli space of curves. [C] Jet spaces and motivic integration; log canonical threshold and the log discrepancy; adjunction and inversion of adjunction; semi-continuity of the log discrepancy. [D] Noncommutative Mori Theory; classification of division rings of dimensions two and three, finite over their centres; noncommutative conic bundles.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5024/

Participants:

Alexeev, Valery (University of Georgia)
Blickle, Manuel (Universitat Essen)
Brion, Michel (Universite de Grenoble)
Cascini, Paolo (UC - Santa Barbara)
Castravet, Ana-Maria (University of Texas, Austin)
Chen, Xi (University of Alberta)
Chen, Linda (Ohio State University)
Chen, Jiun-Cheng (Northwestern University)
Corti, Alessio (University of Cambridge)
de Fernex, Tommaso (University of Utah/ Institute for Advanced Study)
De Jong, Aise Johan (MIT/ Columbia University)
Doherty, Davis (University of Washington)
Farkas, Gavril (University of Texas, Austin)
Gibney, Angela (University of Pennsylvania)
Grushevsky, Samuel (Princeton University)
Hacking, Paul (Yale University)
Hacon, Christopher (University of Utah)
Hassett, Brendan (Rice University)
Heier, Gordon (University of Michigan)
Ingalls, Colin (University of New Brunswick)
Jabbusch, Kelly (University of Washington)
Kebekus, Stefan (Universität zu Köln)
Keel, Sean (University of Texas, Austin)
Kovacs, Sandor (University of Washington)
Kulkarni, Rajesh (Michigan State University)
Kuronya, Alex (Budapest University of Technology and Economics)
La Nave, Gabriele (Lehigh University and Courant Institute)
Matsuki, Kenji (Purdue University)
McKernan, James (UC - Santa Barbara)
Mella, Massimiliano (Universita di Ferrara)
Nevins, Thomas (University of Illinois, Urbana-Champaign)
Nyman, Adam (University of Montana)
Prokhorov, Yuri (Moscow State Lomonosov University)
Reid, Miles (University of Warwick)
Schwede, Karl (University of Washington)
Shokurov, Vyacheslav (Johns Hopkins University)
Smith, Paul (University of Washington)
Tziolas, Nikos (University of Cyprus)
Van den Bergh, Michel (Universiteit Hasselt)
van Opstall, Michael (University of Utah)

Noncommutative Geometry
April 8 - 13, 2006

Organizers:

Alain Connes (College de France)
Joachim Cuntz (University of Muenster)
George Elliott (University of Toronto)
Masoud Khalkhali (University of Western Ontario)
Boris Tsygan (Northwestern University)

A groundbreaking idea of non-commutative geometry, which is emerging as a dominant area of mathematics of the 21th century, is a radical revision of the very notions of space and space-time on which the whole edifice of modern theoretical physics is built. For example, the concept of renormalization, which is one of the most challenging and mysterious aspects of quantum field theory, has been recently demystified by Connes and collaborators, via a natural formulation within the realm of non-commutative geometry, and was shown to have fundamental connections with historically deep questions in number theory, such as the two centuries-old --but yet unsolved-- Riemann hypothesis.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5007/

Participants:

Baum, Paul (Pennsylvania State University)
Bressler, Paul (University of Arizona)
Carey, Alan (Australian National University)
Connes, Alain (College de France)
Consani, Caterina (Johns Hopkins University)
Cuntz, Joachim (University of Muenster)
Echterhoff, Siegfried (Mathematisches Institut, Universität Münster)
Elliott, George (University of Toronto)
Emerson, Heath (University of Victoria)
Gong, Guihua (University of Puerto Rico)
Gorokhovsky, Alexander (University of Colorado, Boulder)
Hajac, Piotr M. (Polish Academy of Sciences)
Kaminker, Jerry (Univerisity of California, Davis)
Kaygun, Atabey (University of Western Ontario)
Khalkhali, Masoud (The University of Western Ontario)
Laca, Marcelo (University of Victoria)
Landi, Giovanni (Universita di Trieste)
Li, Hanfeng (SUNY at Buffalo)
Marcolli, Matilde (Max Planck Institute for Mathematics)
Meyer, Ralf (Universitaet Muenster)
Moscovici, Henri (Ohio State University)
Nest, Ryszard (University of Copenhagen)
Nikolaev, Igor (University of Calgary)
Niu, Zhuang (University of Toronto)
Noohi, Behrang (Max Planck Institute)
Phillips, John (University of Victoria)
Puschnigg, Michael (University de Marseilles)
Putnam, Ian (University of Victoria)
Rangipour, Bahram (University of Victoria)
Rieffel, Marc (University of California, Berkeley)
Sitarz, Andrzej (Jagiellonian University)
Tamarkin, Dima (Northwestern University)
Thom, Andreas (University of Muenster)
Toms, Andrew (University of New Brunswick)
Tsygan, Boris (Northwestern University)
Varghese, Mathai (Erwin Schrödinger Institute / University of Adelaide)
Várilly, Joseph (Universidad de Costa Rica)
Voigt, Christian (Universität Münster)
Wodzicki, Mariusz (University of California, Berkeley)
Yu, Guoliang (Vanderbilt University)

Nonlinear Diffusions: Entropies, Asymptotic Behavior and Applications
April 15 - 20, 2006

Organizers:

Eric Carlen (Georgia Institute of Technology)
José Antonio Carrillo (ICREA)
Jean Dolbeault (University of Paris Dauphine)
Peter Markowich (University of Vienna)
Robert McCann (University of Toronto)

Scientists have long recognized the importance of diffusion in modelling everything from the spread of pollutants to the stock market. If feedback mechanisms are present in the system, then the rates of the process may vary from point to point depending on the gradient and concentration of the material diffusing. The system can then exhibit dramatic transitions, nonlinear behaviour, and pattern formation which challenge prediction and analysis. Such models are used in the manufacture of semiconductors, oil recovery, and the assessments of environmental impact.

A group of leading mathematicians and scientists converged at BIRS to exchange news of the latest discoveries concerning these phenomena, collaborate on vexing problems, and chart the course of research for the upcoming years. Results obtained using different methodologies - theoretical analysis, computer simulations, laboratory experiments - were compared and integrated into an overarching understanding of nonlinear diffusion.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5039/

Participants:

Agueh, Martial (University of Victoria)
Ambrosio, Luigi (Scuola Normale Pisa, Italy)
Andreu, Fuensanta (Universitat de Valencia)
Arnold, Anton (Technische Universitaet Wien)
Aronson, Donald (University of Minnesota)
Caceres, Maria José (Universidad de Granada, Spain)
Carlen, Eric (Georgia Institute of Technology)
Carrillo, José Antonio (ICREA)
Chertock, Alina (North Carolina State University)
Chow, Bennett (University of California, San Diego)
Daskalopoulos, Panagiota (Columbia University)
Denzler, Jochen (University of Tennessee, Knoxville)
Di Francesco, Marco (Universita di L'Aquila,Italy)
Dolbeault, Jean (University of Paris Dauphine)
Fellner, Klemens (University of Vienna,Austria)
Gamba, Irene (University of Texas, Austin)
Gentil, Ivan (University of Paris Dauphine)
Gualdani, Maria (The University of Texas at Austin)
Illner, Reinhard (University of Victoria)
Juengel, Ansgar (University of Mainz, Germany)
Kim, Yong-Jung (Korean Advanced Institute of Science and Technology)
Koch, Herbert (University of Dortmund)
Kurganov, Alexander (Tulane University)
Laugesen, Richard S. (University of Illinois)
Laurençot, Philippe (MIP Toulouse, France)
Ledoux, Michel (Université Paul-Sabatier, Toulouse III)
Lee, Ki-ahm (Seoul National University, Korea)
Loeper, Gregoire (Universite Claude Bernard Lyon 1)
M. Mazón, José (Universidad de Valencia)
Matthes, Daniel (University of Mainz)
McCann, Robert (University of Toronto)
Nazaret, Bruno (University of Paris Dauphine, France)
Ni, Lei (University of California, San Diego)
Panferov, Vladislav (McMaster University)
Puel, Marjolaine (MIP Toulouse, France)
Slepcev, Dejan (UCLA)
Sturm, Karl-Theodor (University of Bonn, Germany)
Vazquez, Juan Luis (Universidad Autonoma de Madrid)
Wunsch, Marcus (University of Vienna)

Schrödinger Evolution Equations
April 22 - 27, 2006

Organizers:

James Colliander (University of Toronto)

Jared Wunsch (Northwestern University)

The recent work on variable coefficient dispersive estimates and almost conservation laws and their applications has been carried out by several teams working in isolation from one another. A main objective was to bring together these groups of allied researchers. These groups, while aware of each others' work, had had little chance to interact in an intensive, structured way. Further interaction between groups using microlocal and geometric techniques developed for linear PDE, those using harmonic analysis tools, and those using methods adapted for rough coefficients and highly nonlinear PDE, would allow the central problems in the field to be viewed more synergistically. The state of the art of research into NLS had become rather difficult for a single mathematician to grasp, as phenomena split into a wealth of special cases depending on choice of dimension, regularity, nonlinearity, and behaviour of coefficients. The workshop offered participants a much-needed broad view of this growing field.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5030/

Participants:

Bejenaru, Loan (University of California, Los Angeles)
Blue, Pieter (University of Toronto)
Burq, Nicolas (Université Paris-Sud)
Carles, Remi (University of Bordeaux)
Colliander, James (University of Toronto)
Craig, Walter (McMaster University)
Doi, Shin-ichi (Osaka University)
Gerard, Patrick (Université Paris-Sud)
Grillakis, Manoussos (University of Maryland)
Guan, Meijiao (UBC)
Gustafson, Stephen (UBC)
Hassell, Andrew (Australian National University)
Holmer, Justin (University of California, Berkeley)
Ibrahim, Slim (McMaster University)
Koch, Herbert (University of Dortmund)
Marzuola, Jeremy (University of California, Berkeley)
Nakamura, Makoto (Mathematical Institute, Tohoku University)
Nakamura, Shu (University of Tokyo)
Nakanishi, Kenji (Kyoto University)
Pigott, Brian (University of Toronto)
Planchon, Fabrice (Université Paris 13)
Raynor, Sarah (Wake Forest University)
Robbiano, Luc (Université de Versailles-Saint Quentin)
Smith, Hart (University of Washington, Seattle)
Staffilani, Gigliola (Massachusetts Institute of Technology)
Tao, Terence (University of California, Los Angeles)
Tataru, Daniel (University of California, Berkeley)
Tsai, Tai-Peng (UBC)
Tzirakis, Nikolaos (University of Toronto)
Visan, Monica (University of California, Los Angeles)
Wright, Doug (University of Minnesota)
Wunsch, Jared (Northwestern University)
Youngren, Drew (Northwestern University)
Zhou, Gang (University of Toronto)
Zwiers, Ian (University of Toronto)

Analytic and Geometric Theories of Holomorphic and CR Mappings
April 29 - May 4, 2006

Organizers:

John Bland (University of Toronto)
Herve Gaussier (University of Provence)
Kang-Tae Kim (Pohang Institute of Science and Technology, Korea)
Steven G. Krantz (Washington University in St. Louis)
Finnur Larusson (University of Western Ontario)
Junjiro Noguchi (University of Tokyo)

As physics guru Roger Penrose says, understanding complex surfaces and mappings is key to basic questions in cosmology and black holes. Many of the world's leading experts on holomorphic and geometric mappings gathered at BIRS to present the latest results and to share new ideas.

Complex surfaces are a mathematical device for modeling the structure and symmetries of the world around us. The subject area draws on all parts of mathematics, including partial differential equations, differential geometry, commutative algebra, group actions, harmonic analysis, and function theory. It is one of the most lively and dynamic parts of our subject, and workers in this field are extraordinarily communicative and collaborative. The workshop was a hotbed of ideas and new results.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5015/

Participants:

Bedford, Eric (Indiana University)
Berteloot, Francois (Universite Paul Sabatier)
Bland, John (University of Toronto)
Bos, Len (University of Calgary)
Brudnyi, Alex (University of Calgary)
Dwilewicz, Roman (University of Missouri)
Eastwood, Michael (University of Adelaide, Australia)
Ebenfelt, Peter (University of California at San Diego)
Fridman, Buma (Wichita State University)
Gauthier, Paul (Universite de Montreal)
Graham, Ian (University of Toronto)
Han, Chong-Kyu (Seoul National University)
Harris, Adam (University of New England)
Hayashimoto, Atsushi (Nagano National College of Technology)
Isaev, Alexander (Australian National University)
Kim, Kang-Tae (Pohang Institute of Science and Technology, Korea)
Kim, Kyounghee (Indiana University)
Kodama, Akio (Kanazawa University)
Krantz, Steven G. (Washington University in St. Louis)
Lanzani, Loredana (University of Arkansas)
Larusson, Finnur (University of Western Ontario)
Lee, Lina (Washington University, St. Louis)
Levenberg, Norm (Indiana University)
Lu, Stephen (Universite de Quebec a Montreal)
Mohammed, Alip (York University)
Nemirovski, Stefan (Steklov Institute)
Noguchi, Junjiro (University of Tokyo)
Schmalz, Gerd (University of New England)
Shafikov, Rasul (University of Western Ontario)
Stensones, Berit (University of Michigan)
Verma, Kaushal (Indian Insitute of Science)

Forests, Fires and Stochastic Modeling
May 6 - 11, 2006

Organizers:

John Braun (University of Western Ontario)
Charmaine Dean (Simon Fraser University)
Fangliang He (University of Alberta)
David Martell (University of Toronto)
Haiganoush Preisler (USDA Forest Service)

Statisticians have an important role to play in the study of various aspects of forestry. The objective of the BIRS workshop was to facilitated interactions between statisticians and researchers that study forest fires and forest ecology.

One theme that emerged in several of the keynote talks as well as in the roundtable discussions was the importance of melding science with statistics. In some of the talks, physically reasonable differential equation models as well as other types of deterministic models were augmented to incorporate the natural variability inherent in some of the systems observed (e.g. animal trajectories, weather, fire behaviour). It is likely that advances in forestry science and statistics will be made rapidly, if these types of approaches are emulated in other situations. The outcome of this meeting was enhanced collaboration among these groups of researchers and an increase in energy and enthusiasm to solve open forestry-related statistical problems.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5062/

Participants:

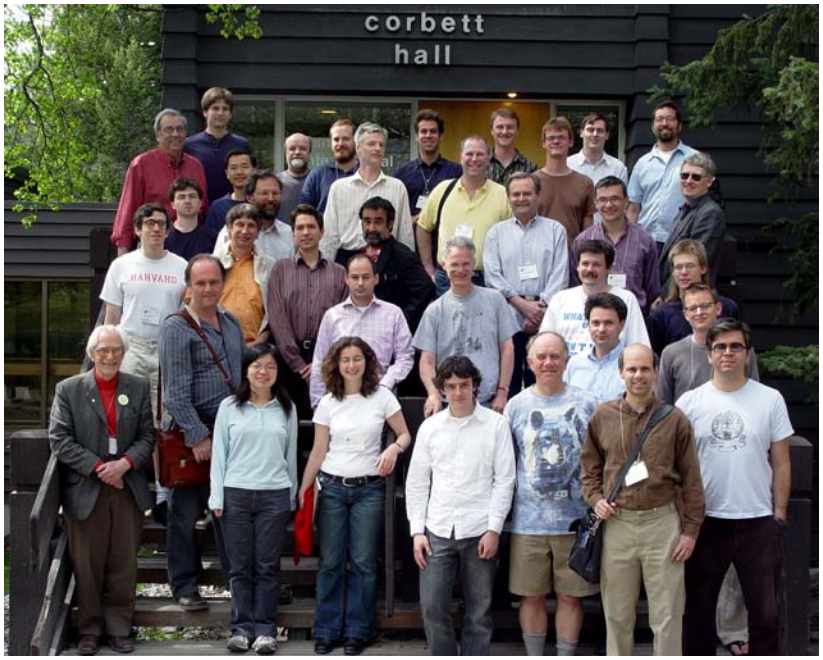
Ainsworth, Laurie (SFU)
Braun, John (University of Western Ontario)
Brillinger, David (University of California, Berkeley)
Campbell, Kirstin (UBC)
Cumming, Steve (Universite Laval)
Dabrowski, Andre (University of Ottawa)
Davies, Katherine (University of Western Ontario)
Dean, Charmaine (SFU)
Esterby, Sylvia (UBC, Okanagan)
Garcia, Tanya (University of Western Ontario)
Gill, Paramjit (UBC, Okanagan)
Gumpertz, Marcia (North Carolina State University)
He, Fangliang (University of Alberta)
Johnson, Ed (University of Calgary)
Kazda, Marian (University of Ulm)
Krawchuk, Meg (University of Alberta)
Kulperger, Reg (University of Western Ontario)
Lele, Subhash (University of Alberta)
Linkletter, Crystal (SFU)
Liu, Frank (Timberline Forest Inventory Consultants)
Lu, Monica (SFU)
Martell, David (University of Toronto)
Michaletz, Sean (University of Calgary)
Mills, Jason (University of Alberta)
Myers, Jason (University of Toronto)
Nathoo, Farouk (SFU)
Nielsen, Jason (SFU)
Perrakis, Dan (Parks Canada)
Preisler, Haiganoush (USDA Forest Service)
Reed, William (University of Victoria)
Routledge, Rick (SFU)
Smith, Bruce (Dalhousie University)
Stanford, David (University of Western Ontario)
Taylor, Steve (Canadian Forest Service)
Turner, Rolf (University of New Brunswick)
Tymstra, Cordy (Sustainable Resource Development)
Wolpert, Robert (Duke University)
Woolford, Doug (University of Western Ontario)
Wotton, Mike (Canadian Forest Service)
Yang, Yang (University of Western Ontario)
Zidek, Jim (UBC)

Analytic Methods for Diophantine Equations
May 13 - 18, 2006

Organizers:

Michael Bennett (University of British Columbia)
Chantal David (Centre de recherches mathématiques)
William Duke (University of California, Los Angeles)
Andrew Granville (University de Montreal)
Yuri Tschinkel (Courant Institute NYU/ University of Goettingen)

Some of the oldest questions in mathematics stem from the desire to find integer solutions to equations. From the equation in Pythagoras' theorem, to Fermat's last theorem, professional and amateur mathematicians alike are thrilled in trying to determine solutions, or to prove there are none. With such a venerable topic it is not surprising that there are many competing approaches to such questions, some whose time has already come, some that are very hot methods right now, and some whose time is yet to come. It was an interesting opportunity for participants from many of the different schools of thought in this subject to come together and find common ground.



For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5101/

Participants:

Balog, Antal (Renyi Institute)
Baragar, Arthur (University of Nevada Las Vegas)
Bennett, Michael (UBC)
Blomer, Valentin (University of Toronto)
Bogomolov, Fedor (New York University)
Boyd, David (UBC)
Browning, Tim (Bristol University)
Ciperiani, Mirela (Columbia University/MSRI)
Colliot-Thélène, Jean-Louis (Université Paris-Sud)
Corvaja, Pietro (University of Udine)
de la Bretèche, Régis (Université Paris-Sud)
Derenthal, Ulrich (Universitaet Goettingen)
Deshouillers, Jean-Marc (University Bordeaux I)
Elkies, Noam (Harvard University)
Ellenberg, Jordan (University of Wisconsin)
Fink, Alex (University of Calgary)
Granville, Andrew (University de Montreal)
Guy, Richard (University of Calgary)
Heath-Brown, Roger (Oxford University)
Helfgott, Harald (Universite de Montreal)
HIRATA-Kohno, Noriko (Nihon University)
Ingram, Patrick (UBC)
Joyce, Michael (Tulane University)
Kisilevsky, Hershy (Concordia University)
Levin, Aaron (MSRI)
Liu, Yu-Ru (University of Waterloo)
Mihailescu, Preda (Universitaet Goettingen)
Pagelot, Sebastien (Grenoble / University of California, Berkeley)
Peyre, Emmanuel (Universite Joseph-Fourier Grenoble I)
Poonen, Bjorn (University of California at Berkeley)
Salberger, Per (Chalmers University of Technology)
Skorobogatov, Alexei (Imperial College London)
Takloo-Bighash, Ramin (Princeton University)
Thunder, Jeff (Northern Illinois University)
Tschinkel, Yuri (Courant Institute NYU and University of Goettingen)
van Luijk, Ronald (PIMS/ SFU/ UBC)
Wong, Siman (University of Massachusetts Amherst/ MSRI)
Wooley, Trevor (University of Michigan)
Zywina, David (University of California, Berkeley)

Optimization problems in financial economics
May 20 - 25, 2006

Organizers:

Jaksa Cvitanic (California Institute of Technology)
Ali Lazrak (University of British Columbia)
Nizar Touzi (ENSAE, Paris)

The BIRS workshop focused on several aspects of optimization problems appearing in finance and economics, and the questions that these raise in terms of mathematical theories. Attention was focused on non linear and/or high-dimensional optimization problems that are commonly encountered in portfolio allocation, asset pricing and contract theory. Recent theoretical and numerical methods on optimizations methods were applied in meaningful financial economics problems.

While many theoretical and numerical advances have been recently realized in the field of optimization techniques such as the Forward Backward Stochastic Differential Equations, it seems that the potential applicability in economics and finance remains to be done. The workshop would be timely because the recent advances open the door for new economic and financial applications and a workshop would give the opportunity to go in these directions. It would greatly help the process of advancing the above topics if a group of leading researchers in this and related fields would get together for a period of time and try to advance with synergy.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5028/

Participants:

Bank, Peter (Columbia University)
Ben Tahar, Imen (Berlin University of Technology)
Berrada, Tony (University of Lausanne)
Bhamra, Harjoat (UBC)
Bouchard, Bruno (Universities Paris VI et VII - CNRS)
Copic, Jernej (California Institute of Technology)
Cottrell, Tom (University of Calgary)
Cvitanic, Jaksa (California Institute of Technology)
Davison, Matt (University of Western Ontario)
deMarzo, Peter (Stanford University)
Detemple, Jerome (Boston University)
Garcia, Diego (Dartmouth College)
Horst, Ulrich (UBC)
Hyndman, Cody (University of Calgary)
Jeanblanc, Monique (University d'Evry Val d'Essonne)
Kramkov, Dmitry (Carnegie Mellon University)
Lazrak, Ali (UBC)
Ludkovski, Mike (University of Michigan)
Ma, Jin (Purdue University)
Meloso, Debrah (California Institute of Technology)
Mueller, Matthias (UBC)
Panageas, Stavros (University of Pennsylvania)
Pham, Huyen (University Paris 7)
Pirvu, Traian (UBC)
Rindisbacher, Marcel (University of Toronto)
Roche, Herve (Instituto Tecnologico Autonomo de Mexico)
Rogers, Chris (University of Cambridge)
Sannikov, Yuliy (University of California Berkeley)
Schachermayer, Walter (Vienna University of Technology)
Sirbu, Mihai (Columbia University)
Skiadas, Costis (Northwestern University)
Wang, Jiang (Massachusetts Institute of Technology)
Wang, Neng (Columbia University)
Wets, Roger (University of California, Davis)
Williams, Noah (Princeton University)
Zhang, Jianfeng (University of Southern California)
Zitkovic, Gordan (University of Texas at Austin)

Interfacial Dynamics in Complex Fluids
May 27 - June 1, 2006

Organizers:

James J. Feng (University of British Columbia)

Chun Liu (Pennsylvania State University)

The problem of interfacial dynamics in complex fluids is clearly multi-disciplinary. But so far the work done by mathematicians, engineers, physicists and material scientists has largely been independent of one another. The sharp-interface methods have been used extensively by physicists and engineers, while the interface regularization methods have been developed mostly by mathematicians. Experimentalists, on the other hand, have documented the physical processes and identified the most important problems that need to be solved. Researchers across the disciplines have so far seldom had the chance to interact and learn of each other's work. This is at least partly owing to the lack of a forum that can attract the full range of researchers tackling such problems from different angles and within different scientific communities. For instance, few mathematicians and fluid dynamicists attend rheology and materials meetings regularly where many practical applications are discussed. Conversely, engineers, rheologists and material scientists rarely participate in applied mathematics conferences and workshops dealing with moving internal boundaries. The general objective of this workshop is to bring together the leading researchers in complex fluids and interfacial dynamics, across several disciplines, to foster awareness and the cross-disciplinary transfer of ideas.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5047/

Participants:

Anna, Shelley (Carnegie-Mellon University)
Banerjee, Sanjoy (UC-Santa Barbara)
Cook, L. Pamela (University of Delaware)
Du, Qiang (Pennsylvania State University)
Feng, James J. (UBC)
Forest, M. Gregory (University of North Carolina-Chapel Hill)
Fried, Eliot (Washington University in St. Louis)
Hu, Howard (University of Pennsylvania)
Jacqmin, David (NASA Glenn Research Center)
Khayat, Roger (University of Western Ontario)
Leal, Gary (University of California-Santa Barbara)
Li, Tiejun (Peking University)
Liu, Chun (Pennsylvania State University)
Longmire, Ellen (University of Minnesota)
Lopez, Juan (Arizona State University)
Minev, Peter (University of Alberta)
Pismen, Len (Israel Institute of Technology)
Renardy, Yuriko (Virginia Polytechnic Institute and State University)
Rey, Alejandro (McGill University)
Ryham, Rolf (Pennsylvania State University)
Shelley, Mike (Courant Institute, New York University)
Shen, Amy (Washington University, St. Louis)
Shen, Jie (Purdue University)
Shi, An-Chang (McMaster University)
Stoeber, Boris (UBC)
Tavener, Simon (Colorado State University)
Thomases, Becca (New York University)
Trebotich, David (Lawrence Livermore National Laboratory)
Vinals, Jorge (McGill University)
Walkington, Noel (Carnegie-Mellon University)
Wang, Qi (Florida State University)
Wielage, Kerstin (UBC)
Xu, Jianjun (University of California, Irvine)
Yu, Wei (Shanghai Jiao Tong University)
Yue, Pengtao (UBC)
Zhang, Pingwen (Peking University)
Zhou, Chunfeng (UBC)
Zhu, Yingxi Elaine (University of Notre Dame)

Modular Forms and String Duality
June 3 - 8, 2006

Organizers:

Charles Doran (University of Washington)
Helena Verrill (Louisiana State University)
Noriko Yui (Queens University)

Modular forms have long played a key role in the theory of numbers, including most famously the proof of Fermat's Last Theorem. Through its quest to unify the spectacularly successful theories of quantum mechanics and general relativity, string theory has long suggested deep connections between branches of mathematics such as topology, geometry, representation theory, and combinatorics. Less well-known are the emerging connections between string theory and number theory the subject of this BIRS workshop. Mathematicians and physicists alike converged for a week of introductory lectures, designed to educate one another in relevant aspects of their subjects, and research talks at the cutting edge of this rapidly growing field.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5041/

Participants:

Aldi, Marco (Northwestern University)
Almkvist, Gert (Lunds Universitet)
Bakhova, Maiia (Louisiana State University)
Ballard, Matthew (University of Washington)
Bouchard, Vincent (Mathematical Sciences Research Institute)
Clingher, Adrian (Stanford University)
Doran, Charles (University of Washington)
Elliott, George (University of Toronto)
Frechette, Sharon (College of the Holy Cross)
Gukov, Sergei (California Institute of Technology)
Herzog, Christopher (University of Washington)
Hosono, Shinobu (University of Tokyo)
Judes, Simon (Columbia University)
Kadir, Shabnam (University of Hannover)
Kaneko, Masanobu (Kyushu University)
Klemm, Albrecht (University of Wisconsin)
Lee, Edward (University of California, Los Angeles)
Lee, Nam-Hoon (Korea Institute for Advanced Study)
Livne, Ron (Hebrew University of Jerusalem)
Long, Ling (Iowa State University)
Lu, Stephen (Universite de Quebec a Montreal)
Ng, Richard (Iowa State University)
Papanikolas, Matthew (Texas A&M University)
Roth, Michael (Queen's University)
Saito, Masahiko (Kobe University)
Scheidegger, Emanuel (Universita del Piemonte Orientale Amadeo Avogadro)
Schimmrigk, Rolf (Indiana University South Bend)
Sebbar, Abdellah (University of Ottawa)
Sebbar, Ahmed (Université Bordeaux 1)
Stienstra, Jan (Utrecht University)
Tsutsumi, Hiroyuki (Osaka University of Health & Sport Sciences)
Verrill, Helena (Louisiana State University)
Walcher, Johannes (Institute for Advanced Study)
Whitcher, Ursula (University of Washington)
Yu, Jeng-Daw (Harvard University)
Yui, Noriko (Queens University)
Zagier, Don (Max Planck Institute for Mathematics)

Evolutionary Game Dynamics
June 10 - 15, 2006

Organizers:

Ross Cressman (Wilfrid Laurier University)
Karl Sigmund (University of Vienna)
Christine Taylor (Harvard University)

The aim of this workshop was to bring together people with different modeling approaches and to allow them to appraise the state of the art in the neighboring fields, as evolutionary games have been approached within several different disciplines with very different traditions and also different channels of communication (journals, conferences etc). The main focus would be on mathematical methodology. Since most of the new methods have been devised by applying those to very concrete examples from biology or experimental games, it was important to also have one or two lectures a day concentrating on new applications, which can range from bacterial genetics to e-commerce. Such new directions would enhance our understanding of evolutionary methods that predict individual behavour modelled by game interactions.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5051/

Participants:

Abrams, Peter (University of Toronto)
Antal, Tibor (Boston University)
Apaloo, Joe (St. Francis Xavier University)
Aydin-Mullen, Yelda (University of Illinois Urbana-Champaign)
Berger, Ulrich (Vienna University of Economics and Business Administration)
Brown, Joel (University of Illinois at Chicago)
Chen, Janet (Harvard University)
Cohen, Yosef (University of Minnesota)
Cressman, Ross (Wilfrid Laurier University)
Dieckmann, Ulf (International Institute for Applied Systems Analysis)
Eshel, Ilan (Tel Aviv University)
Garay, József (Eötvös Loránd University)
Hauert, Christoph (Harvard University)
Hofbauer, Josef (University College London)
Hopkins, Ed (University of Edinburgh)
Imhof, Lorens (Uiversität Bonn)
Iwasa, Yoh (Kyushu University)
Krivan, Vlastimil (Biological Research Center)
Leimar, Olof (Stockholm University)
Lieberman, Erez (Harvard University)
Liekens, Anthony (Technische Universiteit Eindhoven)
Nowak, Martin (Harvard University)
Ohtsuki, Hisashi (Kyushu University)
Pacheco, Jorge (Lisboa University)
Page, Karen (University College London)
Riedel, Frank (Bonn University)
Samuelson, Larry (University of Wisconsin, Madison)
Sandholm, Bill (University of Wisconsin, Madison)
Santos, Francisco (Universite Libre de Bruxelles)
Sigmund, Karl (University of Vienna)
Skyrms, Brian (University of California, Irvine)
Sorin, Sylvain (Université Pierre et Marie Curie Paris 6)
Szabo, Gyorgy (Research Institute for Technical Physics and Materials Science)
Taylor, Christine (Harvard University)
Taylor, Peter (Queen's University)
Traulsen, Arne (Harvard University)
Vincent, Thomas (University of Arizona)
Wild, Geoff (Queen's University)

Creative Writing in Mathematics and Science
June 17 - 22, 2006

Organizers:

Chandler Davis (University of Toronto)
Marjorie Senechal (Smith College)
Jan Zwicky (University of Victoria)
The Writing & Publishing Department (The Banff Centre)

The stunning popularity of recent books, films, and plays about mathematics and science (and/or mathematicians and scientists) reveals a broad public interest in mathematical and scientific ideas. It also shows that gifted writers find in those ideas fertile seeds for their own creativity. Poets, playwrights, fiction and nonfiction writers who treat mathematics and science in their work joined mathematicians who write creatively about their subject in an intensive workshop devoted to giving literary shape to mathematical and scientific ideas. The workshop was co-hosted by BIRS and the Banff Centre's Program in Writing and Publishing.

Mathematicians and writers have much to teach and learn from one another. The mix of literary genres is also productive. Whether the goal is to create fictional or biographical portraits of mathematicians' lives and worries or to convey mathematical ideas in ways that bypass the usual formalism, there is an affinity in our objectives.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5091/

Participants:

Abate, Marco (Universita di Pisa)
Anand, Madhur (Laurentian University)
Bonny, Sandy (University of Alberta)
Burgess, Sarah (University of Victoria)
Chapman, Robin (University of Wisconsin, Madison)
Cipra, Barry (freelance)
Davis, Chandler (University of Toronto)
Desjardins, Sylvie (UBC, Okanagan)
Diacu, Florin (University of Victoria)
Dickinson, Adam (York University)
Dunn, Katharine (freelance writer)
Elmslie, Susan (Dawson College)
Gunderson, Lauren (Freelance Writer)
Holmes, Nancy (UBC, Okanagan)
Kasman, Alex (College of Charleston)
Maddow, Ellen (The Talking Band)
Senechal, Marjorie (Smith College)
Wedin, Randall (Wedin Communications)
Zimet, Paul (Smith College)
Zwicky, Jan (University of Victoria)

First Nations; Mathematics and Science Education
June 17 - 22, 2006

Organizers:

Melania Alvarez (PIMS BC Education Coordinator)
Kelly Kitchen (FNESC Special Education Manager)
Joanne Nakonechny (Director of Science Centre forTeaching and Learning)

The main goal of this workshop on recent and future initiatives in mathematics education for First Nations was to explore the opportunities for aboriginal access to mathematics and science education, as well as the efficacy of different teaching approaches, especially in mathematics.

Participants reported on their various experiences in particular case studies and described whatever significant studies or data may be available concerning these topics or similar ones from other parts of the world. In the end, a document would emerge which would encompass all major issues and could provide a focus for further reflection and action. Turning to the First Nations is a long overdue move on the part of mathematicians and educators, and brings with it not only the usual crop of difficulties but also the promise of fertile new ideas.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5503/

Participants:

Alvarez, Melania (PIMS BC Education Coordinator)
Chambers, Russ (Prinicpal of Skelep School of Excellence)
Crowfoot Clark, Amelia (President of Old Sun Community College/ Superintendent of Siksika Board of Education)
Doolittle, Edward (University of Regina)
Fortier, Warren (UBC)
Fox, Genevieve (Treaty 7: National Special Education)
Glanfield, Florence (University of Saskatchewan)
Hoechsmann, Klaus (PIMS)
Jalan, Rahael (Britannia School)
MacLean, Mark (UBC)
Matthew, Marie (First Nations Education Steering Committee (FNESC))
McKee, Darren (Aboriginal Education Unit of Saskatchewan Learning)
Megginson, Robert (University of Michigan)
Michel, Tim (First Nations Coordinator, UBC)
Nakonechny, Joanne (Director of Science Centre for Teaching anf Learning)
Nicol, Cynthia (UBC)
Sirotic, Natasa (Collingwood School)
Weston, Harley (University of Regina)
Wiseman, Dawn (Coordinator of the Native Access To Engineering Programme at Concordia University)

Statistics at the Frontiers of Science
June 24 - 29, 2006

Organizers:

David Brillinger (University of California, Berkeley)
Gemai Chen (University of Calgary)
Jianqing Fan (Princeton University)
Jun Liu (Harvard University)
Jim Ramsay (McGill University)
Keith Worsley (McGill University)

Taking a range of numbers as input to understand what is going on, quantifying tissue changes such as those in our brains, figuring out the ups and downs in financial markets, understanding the origin of life, developing new drugs, modeling the history of events of interest, were some of the many topics discussed in this workshop on Statistics at the Frontier of Science. The workshop focused on the most advanced statistical methodology that is fast developing in order to address some of the major challenges in modern scientific research.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5073/

Participants:

Adler, Robert (Technion - Israel Institute of Technology)
Brown, Emery (Massachusetts Institute of Technology)
Buhlmann, Peter (Swiss Federal Institute of Technology in Zurich)
Burke, Murray (University of Calgary)
Chen, Gemai (University of Calgary)
Chen, Rong (University of Illinois at Chicago)
Davis, Richard (Colorado State University)
Fan, Jianqing (Princeton University)
Fuh, Cheng-Der (Academia Sinica)
Gervini, Daniel (University of Wisconsin at Milwaukee)
Hooker, Giles (McGill University)
James, Gareth (University of Southern California)
Jank, Wolfgang (University of Maryland)
Kneip, Alois (University of Bonn)
Kou, Samuel (Harvard University)
Li, Wai. K. (University of Hong Kong)
Linton, Oliver (London School of Economics)
Liu, Jun (Harvard University)
Lockhart, Richard (SFU)
McLeod, Ian (University of Western Ontario)
McPeek, Mary Sara (University of Chicago)
Mueller, Hans-Georg (University of California, Davis)
Mykland, Per (University of Chicago)
Ramsay, Jim (McGill University)
Rohani, Farzan (McGill University)
Schmidt, Volker (University of Ulm)
Shumway, Robert (University of California, Davis)
Smith, Bruce (Dalhousie University)
Sun, Jiayang (Case Western Reserve University)
Valdés-Sosa, Pedro A. (Cuban Neuroscience Centre)
Wang, Yazhen (University of Connecticut)
Worsley, Keith (McGill University)
Wu, Yingnian (University of California, Los Angeles)
Yao, Fang (Colorado State University)
Zhao, Hongyu (Yale University)

Computational and Statistical Genomics
July 8 - 13, 2006

Organizers:

Jennifer Bryan (University of British Columbia)
Sandrine Dudoit (University of California, Berkeley)
Sunduz Keles (University of Wisconsin, Madison)
Katherine S. Pollard (University of California, Davis)
Mark van der Laan (University of California-Berkeley)

High-throughput biotechnologies, such as DNA microarrays, provide the unprecedented and extraordinary opportunity to investigate biological processes on a genomic-scale. The resulting biological discoveries have promising and profound implications in terms of basic science and public health. However, our ever-growing capacity to generate massive and diverse biological datasets has far outpaced our ability to analyze and interpret these data. The combined analysis of high-dimensional complex biological and medical datasets, of multiples types and from multiple sources, is stretching the limits of existing computational and statistical methods.

The main goals of the workshop were to foster close and sustained collaborations between statisticians and biologists. Such interactions are essential to the sound translation of existing and emerging biological problems into computational and statistical questions and the development of analysis methods and software that will allow biologists and clinicians to get the most out of the wealth of data at their disposal in-house and on the WWW.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5076/

Participants:

Allison, David (University of Alabama,Birmingham)
Ansari, Aseem (University of Wisconsin Madison)
Brem, Rachel (UC-Berkeley)
Bryan, Jennifer (UBC)
Chun, Hyonho (University of Wisconsin, Madison)
Dopazo, Joaquin (Centro de Investigacion Principe Felipe)
Fodor, Imola (Lawrence Livermore National Laboratory)
Fridlyand, Jane (UC-San Francisco)
Hansen, Kasper (UC-Berkeley)
Hinds, David (Perlegen Sciences)
Horvath, Steve (UCLA)
Hothorn, Torsten (Friedrich-Alexander-Universität, Erlangen-Nürnberg)
Hothorn, Ludwig (University of Hanover)
Hughes, Tim (University of Toronto)
Jornsten, Rebecka (Rutgers University)
Keles, Sunduz (University of Wisconsin, Madison)
Larget, Bret (University of Wisconsin, Madison)
Lieb, Jason (University of North Carolina, Chapel Hill)
Majewski, Jacek (McGill University)
Molinaro, Annette (Yale University)
Pollard, Katherine S. (UC-Davis)
Quackenbush, John (Dana-Farber Cancer Institute)
Rocke, David (UC-Davis)
Ruczinski, Ingo (Johns Hopkins University)
Segal, Mark (UC-San Francisco)
Siepel, Adam (Cornell University)
Speed, Terry (UC-Berkeley)
Taylor, Sandy (UC-Davis)
Temple Lang, Duncan (UC-Davis)
Wasserman, Wyeth (UBC)
Yildiz, Fitnat (UC-Santa Cruz)
Zhao, Hongyu (Yale University)

Statistical inference Problems in High Energy Physics and Astronomy
July 15 - 20, 2006

Organizers:

James Linnemann (Michigan State University)
Louis Lyons (University of Oxford)
Nancy Reid (University of Toronto)

Lord Rutherford famously said that any physicist who needs statistics has done the wrong experiment! Times have changed enormously since then, an internationally renowned group of high energy physicists met at BIRS to discuss their experiments with some leading statistical scientists. The search for exotic particles like the Higgs boson involves analyzing hundreds of millions of events, looking for the rare signal in the haystack. Statistical techniques play an important role in understanding both systematic and random fluctuations, in classifying events, and in providing means to assess the uncertainty in reported conclusions from these large scale experiments. The meeting followed a number of larger PHYSTAT conferences, that had been held in Durham, Stanford and Oxford, but was the first to be organized jointly with statisticians, with the explicit goal of producing a written summary of the current `state of the art' in combining the latest results in statistical research with the needs of high energy physicists.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5054/

Participants:

Bailey, Stephen (Lawrence Berkeley National Lab)
Barlow, Roger (Manchester University)
Blobel, Volker (DESY Lab Hamburg)
Bueno, James (UBC)
Burnett, Toby (University of Washington)
Conrad, Jan (Royal. Inst. Technology (KTH))
Cranmer, Kyle (Brookhaven Nat Lab)
Davison, Anthony (Ecole Polytechnique Fédérale de Lausanne)
Demortier, Luc (Rockefeller University)
Fraser, Don (University of Toronto)
Heinrich, Joel (University of Pennsylvania)
Jin, Zi (University of Toronto)
Junk, Tom (University of Illinois Urbana-Champaign)
LePage, Raoul (Michigan State University)
Linnemann, James (Michigan State University)
Lockhart, Richard (SFU)
Lyons, Louis (University of Oxford)
Marchand, Eric (University of Sherbrooke)
Meinshausen, Nicolai (UC-Berkeley)
Meng, Xiao-Li (Harvard University)
Narsky, Ilya (California Institute of Technology)
Neal, Radford (University of Toronto)
Punzi, Giovanni (University of Pisa)
Reid, Nancy (University of Toronto)
Roe, Byron (University of Michigan)
Rolke, Wolfgang (University of Puerto Rico)
Sartori, Nicola (University of Venice)
Schwienhorst, Reinhard (Michigan State University)
Sen, Bodhisattva (University of Michigan)
Siemiginowska, Aneta (Harvard-Smithsonian Center for Astrophysics)
Vachon, Brigitte (McGill University)
Van Dyk, David (UC-Irvine)
Zech, Gunter (University of Siegen)

Moduli Spaces and Combinatorics
July 22 - 27, 2006

Organizers:

Jim Bryan (University of British Columbia)
Richard Kenyon (University of British Columbia)
Andrei Okounkov (Princeton University)
Rahul Pandharipande (Princeton University)

Mathematicians from North America and Europe gathered at BIRS to discuss recent developments in the theory of moduli spaces. A moduli space is a fancy name for the set of shapes which an object can take: imagine for example the set of configurations of a robot arm which is composed of several linkages, or the set of configurations of a complicated molecule such as a polymer whose individual atoms can be folded in many different ways. The other word in the title, combinatorics, refers to counting. Techniques for counting configurations of discrete subsets of spaces of configurations often play a fundamental role in the understanding of a moduli space. Recent research by some of the participants has shown sophisticated connections between moduli spaces and string theory, with classical combinatorial theorems linking previously unconnected concepts.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5087/

Participants:

Borodin, Alexei (California Institute of Technology)
Bryan, Jim (UBC)
Calta, Kariane (Cornell University)
Carlsson, Erik (Princeton University)
Cavelieri, Renzo (University of Michigan)
Craw, Alastair (Stony Brook University)
Faber, Carel (Kungliga Tekniska Högskolan (KTH))
Farkas, Gavril (University of Texas, Austin)
Gholampour, Amin (UBC)
Goulden, Ian (University of Waterloo)
Jackson, David (University of Waterloo)
Jiang, Yunfeng (University of Utah)
Karp, Dagan (University of California, Berkeley)
Kenyon, Richard (UBC)
Knutson, Allen (University of California, San Diego)
Lelievre, Samuel (University of Warwick)
Liu, Chiu-Chu (Melissa) (Northwestern University)
Maclagan, Diane (Rutgers University)
Maulik, Davesh (Princeton University)
Mikhalkin, Grigory (University of Toronto)
Millar, Jessica (UBC)
Okounkov, Andrei (Princeton University)
Pandharipande, Rahul (Princeton University)
Proudfoot, Nicholas (Columbia University)
Purbhoo, Kevin (UBC)
Romik, Dan (University of California, Berkeley)
Smillie, John (Cornell University)
Szendroi, Balazs (Mathematical Institute, University of Oxford)
Thaddeus, Michael (Columbia University)
Tseng, Hsian-hua (UBC)
Vakil, Ravi (Stanford University)
van Willigenburg, Stephanie (UBC)
Young, Ben (UBC)
Yu, Josephine (University of California, Berkeley)

Spin, Charge, and Topology in low dimensions
July 29 - August 3, 2006

Organizers:

Valeri Frolov (University of Alberta/ Institute of Theoretical Physics)
George Sawatzky (University of British Columbia)
Boris Spivak (University of Washington)
Philip Stamp (University of British Columbia)
William Unruh (University of British Columbia)
Shoucheng Zhang (Stanford University)

This workshop was part of a joint PITP/PIMS research programme. The emphasis was on topology, quantum information, spin and charge, and the general areas of strongly correlated physics and quantum magnetism. The last 2 years have seen some remarkable cross-disciplinary work between all these fields, both in mathematics and physics - these developments are almost as remarkable for their mathematical novelty as their importance for physics.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5080/

Participants:

Amin, Mohammad (D-Wave Systems Inc.)
Berciu, Mona (UBC)
Brennen, Gavin (Institute for Quantum Optics and Quantum Information)
Burin, Alex (Tulane University)
Chang, Ming-Shyang (UBC)
Frolov, Valeri (University of Alberta, Institute of Theoretical Physics)
Fursaev, Dimitri (Joint Institute for Nuclear Research)
Goswami, R. (University of Alberta)
Haldane, F. Duncan M. (Princeton University)
Hines, Andrew (UBC)
Hoyos Neto, Jose (University of Missouri-Rolla)
Imry, Yoseph (Weizmann Institute)
Jain, Janindra (Penn State)
Kubiznak, David (University of Alberta)
Lee, Taejin (Kangwon National University)
Nagaosa, Naoto (University of Tokyo)
Pereira, Rodrigo (UBC)
Raussendorf, Robert (Perimeter Institute)
Rezakhani, Ali (University of Calgary, Institute for Quantum Information Science)
Sanders, Barry (University of Calgary)
Schuetzold, Ralf (Technische Universität Dresden)
Seradjeh, Babak (SFU)
Spivak, Boris (University of Washington)
Stamp, Philip (UBC)
Thompson, Lara (UBC)
Tupitsyn, Igor (UBC)
Unruh, William (UBC)
Xiao, Di (University of Texas, Austin)
Zagoskin, Alexandre (UBC)
Zelnikov, Andrei (University of Alberta)
Zhang, Shoucheng (Stanford University)

Measurable Dynamics, Theory and Applications
August 5 - 10, 2006

Organizers:

Chris Bose (University of Victoria)
Pawel Gora (Concordia University)
Brian Hunt (University of Maryland)
Anthony Quas (University of Victoria)

World experts met at BIRS to discuss recent developments in the fast-moving field of Measurable Dynamics. Measurable dynamics has its origins in the 19th Century when scientists were grappling with problems of thermodynamics in chemistry, engineering and physics. Since then, the discipline has matured into a subject in its own right. In recent years, exciting connections have been established between measurable dynamics and other areas of mathematics: geometry, prime numbers and probability to name a few.

Meanwhile, there has been an explosive development in the theory of dynamical systems ("chaos theory"), both theoretically and practically with applications to subjects as diverse as the stock market, economics, biology and engineering.

The workshop brought together experts in measurable dynamics together with specialists in chaos theory as well as scientists in neighbouring disciplines. The aim was to strengthen connections between these groups of people in order to shape the development of the subject, and to share and advance knowledge.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5079/

Participants:

Ashwin, Peter (University of Exeter)
Bahsoun, Wael (Univertiy of Victoria/PIMS)
Bergelson, Vitaly (Ohio State University)
Berger, Arno (University of Canterbury)
Bollt, Erik (Clarkson University)
Bose, Chris (University of Victoria)
Branton, Sheena (University of Houston)
Campbell, James (University of Memphis)
Choe, Geon-H (Korea Advanced Institute of Science and Technology)
Froyland, Gary (University of New South Wales)
Gora, Pawel (Concordia University)
Gunturk, Sinan (Courant Institute of Mathematical Sciences)
Hunt, Brian (University of Maryland)
Jenkinson, Oliver (Queen Mary - University of London)
Keller, Gerhard (Universitat Erlangen-Nuernberg)
Kennedy, Judy (University of Delaware)
Kra, Bryna (Northwestern University)
Marcus, Brian (UBC)
McClendon, David (University of Maryland)
Meiss, Jim (University of Colorado, Boulder)
Melbourne, Ian (University of Surrey)
Murray, Rua (Waikato University - New Zealand)
Nicol, Matt (University of Houston)
Ott, William (Courant Institute of Mathematical Sciences)
Pavlov, Ronnie (Ohio State University)
Quas, Anthony (University of Victoria)
Rudnicki, Ryszard (Institute of Mathematics PAS and Silesian University-Poland)
Sahin, Ayse (DePaul University)
Sander, Evelyn (George Mason University)
Santitissadeekorn, Naratip (Clarkson University)
Yorke, James (University of Maryland)

Geometric and Nonlinear Analysis
August 12 - 17, 2006

Organizers:

Matthew Gursky (University of Notre-Dame)
Emmanuel Hebey (Universite de Cergy-Pontoise)
Frederic Robert (Université de Nice-Sophia Antipolis)

Geometric analysis has always been a meeting point between geometry and analysis. Indeed, this workshop focused on its mutual influence and interaction with nonlinear analysis. It was the organizers' intention to cover a wide range of topics by bringing together participants from various domains. Vigorous interactions, fruitful discussions and collaborations were expected to happen from this workshop. The marvelous setting and secluded environment of BIRS inspired the dozens of young postdocs or PhD students who were invited to participate to this event.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5090/

Participants:

Albin, Pierre (MIT)
Brenier, Yann (University of Nice)
Cassani, Daniele (UBC)
Catino, Giovanni (Universita di Pisa)
Chang, Alice (Princeton University)
Coda Marques, Fernando (Instituto de Matematica Pura e Aplicada)
Dafermos, Mihalis (University of Cambridge)
Druet, Olivier (Ecole Normale Supérieure de Lyon)
Fan, Edward (Princeton University)
Ge, Yuxin (Université Paris XII-Val de Marne)
Ghoussoub, Nassif (BIRS/ UBC)
Grunau, Hans-Christoph (Otto-von-Guericke-Universität Magdeburg)
Guan, Pengfei (McGill University)
Guillarmou, Colin (Université de Nice)
Han, Zheng-Chao (Rutgers University)
Hebey, Emmanuel (Universite de Cergy-Pontoise)
Humbert, Emmanuel (Université Henri Poincaré Nancy)
Kim, Seongtag (Inha University)
Malchiodi, Andrea (International School for Advanced Studies)
Mazzeo, Rafe (Stanford University)
McCann, Robert (University of Toronto)
Moller, Niels Martin (University of Aarhus)
Pacard, Frank (Université Paris 12-val de Marne)
Qing, Jie (UC-Santa Cruz)
Raske, David (UC-Riverside)
Robert, Frederic (Université de Nice-Sophia Antipolis)
Schwartz, Fernando (Duke University)
Struwe, Michael (ETH Zentrum)
Van der Vorst, Robertus C.A.M. (Vrije Universiteit Amsterdam)
Williams, Catherine (University of Washington)
Yan, Yu (UBC)
Yang, Paul (Princeton University)

Inverse Problems and Applications
August 19 - 24, 2006

Organizers:

Gary Margrave (University of Calgary)
Gunther Uhlmann (University of Washington)

The workshop focused on the hottest new results in both theoretical and practical aspects of inverse problems. Inverse Problems are problems where causes for a desired or observed effect are to be determined and they arise in all fields of science and industry. The experts in this meeting discussed recent results on medical imaging techniques like elastography, electric impedance tomography, magnetic resonance imaging, optical tomography and thermoacoustic tomography among others. Other topics of discussion were new imaging techniques used in oil exploration and remote sensing.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5092/

Participants:

Bal, Guillaume (Columbia University)
Bao, Gang (Michigan State University)
Borcea, Liliana (Rice University)
Cakoni, Fioralba (University of Delaware)
Colton, David (University of Delaware)
de Hoop, Maarten (Purdue University)
Donaldson, Roger (California Institute of Technology)
Dos Santos Ferreira, David (Université Paris 13)
Finch, David (Oregon State University)
Fishman, Lou (MDF International)
Gibson, Peter (York University)
Greenleaf, Allan (University of Rochester)
Isaacson, David (RPI)
Isakov, Victor (Wichita State University)
Kang, Hyeonbae (Seoul National University)
Knudsen, Kim (Aalborg University)
Kuchment, Peter (Texas A&M University)
Lamoureux, Michael (University of Calgary)
Langmore, Ian (University of Washington, Seattle)
Lassas, Matti (Helsinki University of Tecnology)
Margrave, Gary (University of Calgary)
McDowall, Stephen (Western Washington University)
McLaughlin, Joyce (Rensselaer Polytechnic Institute)
Monk, Peter (University of Delaware)
Nakamura, Gen (Hokkaido University)
Nolan, Clifford (University of Limerick)
Ren, Kui (Columbia University)
Rundell, William (Texas A&M University)
Salo, Mikko (University of Helsinki)
Schotland, John (University of Pennsylvania)
Siltanen, Samuli (Palodex Group)
Stefanov, Plamen (Purdue University)
Tzou, Leo (University of Washington)
Uhlmann, Gunther (University of Washington)
Vasy, András (Stanford University)
Villegas, Carlos (UNAM)
Vogelius, Michael (Rutgers University)
Wang, Jenn-Nan (National Taiwan University)
Yedlin, Matt (UBC)
Zhao, Hongkai (UC-Irvine)

Recent Advances in Computational Complexity
August 26 - 31, 2006

Organizers:

Stephen Cook (University of Toronto)
Arvind Gupta (Simon Fraser University)
Russell Impagliazzo (University of California, San Diego)
Valentine Kabanets (Simon Fraser University)
Madhu Sudan (Masachusetts Institute of Technology)
Avi Wigderson (Princeton University).

A salient feature of the current research in computational complexity is the interpenetration of ideas from different fields of computer science and mathematics: coding theory, information theory, bounded arithmetic, and number theory, to name just a few. Some of the most exciting recent developments in theoretical computer science were the result of such exchange of ideas. (For example, an elementary combinatorial construction of constant-degree expander graphs due to Reingold, Vadhan, and Wigderson came as a result of applying the information-theoretic techniques developed in the study of randomness extractors.) By bringing together the computer scientists working in logic, coding theory, computational randomness, and quantum computing, such fruitful interaction among different research areas of computational complexity continued.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5031/

Participants:

Aaronson, Scott (University of Waterloo)
Akavia, Adi (Mit)
Allender, Eric (Rutgers University)
Amiri, Ehsan (SFU)
Beame, Paul (University of Washington)
Ben-Sasson, Eli (Technion)
Buresh-Oppenheim, Josh (SFU)
Cleve, Richard (University of Waterloo)
Cook, Stephen (University of Toronto)
Dvir, Zeev (Weizmann Institute)
Fortnow, Lance (University of Chicago)
Gavinsky, Dmitry (University of Calgary)
Guruswami, Venkatesan (University of Washington)
Impagliazzo, Russell (UC-San Diego)
Jaiswal, Ragesh (UC-San Diego)
Kabanets, Valentine (SFU)
Kapron, Bruce (University of Victoria)
Khot, Subhash (Georgia Tech)
Kindler, Guy (Microsoft Research)
Klivans, Adam (University of Texas, Austin)
Kolokolova, Antonina (SFU)
McKenzie, Pierre (University of Montreal)
O'Donnell, Ryan (Microsoft Research)
Pitassi, Toni (University of Toronto)
Rao, Anup (University of Texas, Austin)
Raz, Ran (Weizmann Institute of Science)
Regev, Oded (Tel-Aviv University)
Saks, Michael (Rutgers University)
Santhanam, Rahul (SFU)
Shaltiel, Ronen (University of Haifa)
Shpilka, Amir (Technion)
Sudan, Madhu (MIT)
Szegedy, Mario (Rutgers University)
Ta-Shma, Amnon (Tel-Aviv University)
Umans, Chris (California Institute of Technology)
Vadhan, Salil (Harvard University)
Valiant, Paul (MIT)
van Melkebeek, Dieter (University of Wisconsin)
Zare, Habil (SFU)
Zuckerman, David (University of Texas, Austin)

Algebraic groups, quadratic forms and related topics
September 2 - 7, 2006

Organizers:

Vladimir Chernousov (University of Alberta)
Richard Elman (University of California, Los Angeles)
Alexander Merkurjev (University of California, Los Angeles)
Jan Minac (University of Western Ontario)
Zinovy Reichstein (University of British Columbia)

The recent past has seen a rapid growth and development in the theory of algebraic groups. The proof of the Bloch-Kato conjecture, first announced by Voevodsky during the highly successful BIRS 5-day workshop on Quadratic forms, algebraic groups and Galois cohomology (October 2003), is currently the topic of the year long program on at the Institute for Advanced Study in Princeton (2004/2005). The full scope of the applications of the new emerging techniques within the theory of algebraic groups remains to be fully explored.

The workshop intended to be a sequel to the above-mentioned October 2003 meeting. Its purpose was to provide a forum for the experts in the theories of algebraic groups and quadratic forms to exchange ideas, disseminate new techniques, and discuss recent developments. Given the current state of the field and the success of the previous 5-day BIRS workshop on these topics, this meeting was once again highly productive.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5025/

Participants:

Baeza, Ricardo (University of Talca)
Bayer-Fluckiger, Eva (Ecole Polytechnique Federale de Lausanne)
Belkale, Prakash (University of North Carolina, Chapel hill)
Blunk, Mark (UCLA)
Brosnan, Patrick (UBC)
Cai, Shuang (UCLA)
Calmes, Baptiste (ETH Zurich)
Carrell, James (UBC)
Chernousov, Vladimir (University of Alberta)
Elman, Richard (UCLA)
Florence, Mathieu (University of Bielefeld)
Friedlander, Eric (Northwestern University)
Gille, Philippe (Université Paris XI)
Gille, Stefan (University of Munich)
Haesemeyer, Christian (University of Illinois at Urbana-Champaign)
Hoffmann, Detlev (University of Nottingham)
Karpenko, Nikita (Université Paris 6)
Krashen, Daniel (Yale University)
Kuttler, Jochen (University of Alberta)
Laghribi, Ahmed (Université d'Artois)
Lemire, Nicole (University of Western Ontario)
Mare, Augustin-Liviu (University of Regina)
Merkurjev, Alexander (UCLA)
Minac, Jan (University of Western Ontario)
Mocanasu, Mona (Northwestern University)
Morris, Dave (University of Lethbridge)
Nenashev, Alexander (Glendon College/York University)
Ondrus, Alex (University of Alberta)
Pevtsova, Julia (University of Washington)
Pop, Florian (University of Pennsylvania)
Rehmann, Ulf (University of Bielefeld)
Reichstein, Zinovy (UBC)
Saltman, David J (University of Texas)
Schlichting, Marco (Louisiana State University)
Serre, Jean-Pierre (College de France)
Swallow, John (Davidson College)
Tignol, Jean-Pierre (Université catholique de Louvain)
Vishik, Alexander (Institute for Information Transmission Problems, R.A.S.)
Vishne, Uzi (Bar Ilan University)
Vistoli, Angelo (University of Bologna)
Zainoulline, Kirill (University of Bielefeld)

Evolution of microscopic and macroscopic fields
September 9 - 14, 2006

Organizers:

Juerg Froehlich (Swiss Institute of Technology Zuerich (ETH))
Israel Michael Sigal (University of Toronto)
Avy Soffer (Rutgers University)
Michael Weinstein (Columbia University)

Modern applied mathematics grew, in a large part, out of the problems posed by classical physics, such as Celestial Mechanics, Electro-Magnetism and Fluid Dynamics. Modern Mathematical Physics, on the other hand, has its roots in quantum theory. The latter theory explains phenomena involving atomic and subatomic particles (length scales of order of 1 Ångström or 10-8 cm and smaller). Its applications used to be somewhat remote and special (e.g. nuclear energetics, lasers and superconductors). This condition has changed dramatically, however, in the last few years with electronic, optical and communication devices reaching the quantum scale and with research into and the promise of quantum computing and quantum information transmission.

This new situation calls for closer integration of the applied mathematics and mathematical physics communities. The workshop was the first step in this direction. It brought together applied mathematicians, mathematical physicists and theoretical physicists to concentrate on the problems posed by analysis of the evolution equations of quantum physics.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5077/

Participants:

Bach, Volker (Johannes Gutenberg University, Mainz)
Berman, Gennady (Los Alamos National Laboratory)
Bronski, Jared (University of Illinois Urbana-Champaign)
Burchard, Almut (University of Toronto)
Castin, Yvan (Laboratoire Kastler Brossel, Ecole normale supérieure)
Craig, Walter (McMaster University)
Erdos, Laszlo (Ludwig Maximilians Universitat Muenchen)
Goriely, Alain (University of Arizona)
Gustafson, Stephen (UBC)
Hasler, David (University of Virginia)
Jonsson, Lars (Swiss Institute of Technology Zuerich (ETH))
Joye, Alain (Institut Fourier, Universite de Grenoble)
Kirr, Eduard (University of Illinois Urbana-Champaign)
Knowles, Antti (Theoretische Physik ETH Zürich)
Lenzmann, Enno (MIT)
Lieb, Elliott H. (Princeton University)
Loss, Michael (Georgia Institute of Technology)
Merkli, Marco (Memorial University)
Rodnianski, Igor (Princeton University)
Schlag, Wilhelm (University of Chicago)
Schlein, Benjamin (Harvard University)
Seiringer, Robert (Princeton University)
Shipman, Stephen (Louisiana State University)
Shlizerman, Eli (Weizmann Institute)
Shlyapnikov, Gora (LPTMS, Universite Paris Sud)
Sigal, Israel Michael (University of Toronto)
Soffer, Avy (Rutgers University)
Stuart, David (University of Cambridge, DAMPT)
Stucchio, Chris (Rutgers University)
Sulem, Catherine (University of Toronto)
Teismann, Holger (Acadia University)
Tsai, Tai-Peng (UBC)
Tumulka, Roderich (Eberhard-Karls-Universität)
Weinstein, Michael (Columbia University)
Yau, H-T (Harvard University)
Zhou, Gang (University of Toronto)

Topics on von Neumann algebras
September 16 - 21, 2006

Organizers:

Juliana Erlijman (University of Regina)
Hans Wenzl (University of California, San Diego)

There have been exciting developments in the theory of von Neumann algebras with close connections to recent works in quantum mechanics, topology and representation theory of infinite groups. Major emphasis was given to Popa's recent break-throughs in von Neumann algebras which are connected to rigidity theorems in group theory as well as to Jones' subfactor theory. The latter already had deep applications in topology and intriguing connections to quantum field theory. It also inspired at least in part
Freedman's work on quantum computing.

The workshop was a great opportunity for the participants to make further progress on these exciting topics, as well as for younger people to get exposed to the latest developments.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5086/

Participants:

Argerami, Martin (University of Regina)
Asaeda, Marta (UC-Riverside)
Bisch, Dietmar (Vanderbilt University)
Ciuperca, Alin (University of Toronto)
Dykema, Ken (Texas A&M University)
Elliott, George (University of Toronto)
Erlijman, Juliana (University of Regina)
Evans, David (Cardiff University)
Gannon, Terry (University of Alberta)
Ghosh, Shamindra (University of New Hampshire)
Goodman, Frederick (University of Iowa)
Grossman, Pinhas (UC-Berkeley)
Haagerup, Uffe (University of Southern Denmark)
Hauschild Mosley, Holly (Grinnell College)
Ioana, Adrian (UCLA)
Izumi, Masaki (Kyoto University)
Jones, Vaughan (UC-Berkeley)
Jung, Kenley (UCLA)
Kawahigashi, Yasuyuki (University of Tokyo)
Longo, Roberto (University of Rome Tor Vergata)
Massey, Pedro (Universidad de la Plata/Argentina and University of Regina)
Monod, Nicolas (University of Geneva)
Musat, Magdalena (University of Memphis)
Niu, Zhuang (University of Calgary)
Ozawa, Narutaka (University of Tokyo)
Peterson, Jesse (UC-Berkeley)
Pichot, Mikaël (Institut des Hautes Etudes Scientifiques (IHES))
Popa, Sorin (University of California, Los Angeles)
Robert, Leonel (Fields Institute)
Rowell, Eric (Texas A&M University)
Santiago Moreno, Luis (University of Toronto)
Sasyk, Román (Purdue University)
Shlyakthenko, Dmitri (University of California, Los Angeles)
Sunder, V.S. (The Institute of Mathematical Sciences)
Tuba, Imre (San Diego State University, Imperial Valley Campus)
Vaes, Stefaan (Institut de Mathématiques de Jussieu)
Viola, Maria Grazia (Queen's University)
Wassermann, Antony (CNRS/Institut de Mathematiques, Luminy)
Wenzl, Hans (University of California, San Diego)
Xu, Feng (UC-Riverside)

Women in Mathematics
September 23 - 28, 2006

Organizers:

Gerda de Vries (University of Alberta)
Malgorzata Dubiel (Simon Fraser University)
Clara Garza-Hume (Universidad Nacional Autónoma de México (UNAM))
Barbara Lee Keyfitz (Fields Institute/University of Houston)
Chawne Kimber (Lafayette College)
Rachel Kuske (University of British Columbia)
Marni Mishna (Simon Fraser University)

Talented women have made, and are making valuable contributions to the mathematical community, mathematics research and mathematics education in Canada, the United States and Mexico. The talks and discussions at the very successful Second Connecting Women in Mathematics in Canada (CWiMAC) workshop, which took place at BIRS July 21 – 23, 2005, demonstrated that there are still many issues of concern related to the careers of women in mathematics, both in Canada and in North America in general: for example retention of talented women beyond the PhD stage, and improving the academic climate for women who wish to balance family and career.

The 5-day workshop brought together women mathematicians from Canada, the US, and Mexico, and men who have an interest in supporting women's issues and who are in a position to influence the policies and strategies of the institutes and professional organizations. The participants had the opportunity to interact through panels, break-out groups and informal discussions and engage in scientific exchanges. These activities provided opportunities to network and to identify specific issues relevant to supporting diversity at different stages of mathematical careers. They developed recommendations for future collaboration and for activities in support of women in mathematics. They examined what the institutes and professional organizations are doing now to support women, and what other initiatives can be undertaken.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5504/

Participants:

Armour, Margaret-Ann (University of Alberta)
Arnold, Douglas (University of Minnesota)
Blum, Lenore (Carnegie Mellon University)
Bonfert-Taylor, Petra (Wesleyan University)
Calderer, Maria-Carme (University of Minnesota)
Conrey, Brian (American Institute of Mathematics)
David, Chantal (Centre de recherches mathématiques (CRM))
Dubiel, Malgorzata (SFU)
Fan, Danny (BIRS)
Faridi, Sara (Dalhousie University)
Folch, Magali (UNAM)
Garza-Hume, Clara (Universidad Nacional Autónoma de México (UNAM))
Golubitsky, Martin (University of Houston)
Green, Mark (University of California, Los Angeles)
Hamel, Sylvie (Universite de Montreal)
Haxell, Penny (University of Waterloo)
Herzig, Abbe (State University of New York, Albany)
Horst, Ulrich (UBC)
Jones, Chris (University of North Carolina/University of Warwick)
Jorge, Maria del Carmen (Universidad Nacional Autónoma de México (UNAM))
Kessel, Cathy (Mathematics Education Consultant)
Keyfitz, Barbara Lee (Fields Institute/University of Houston)
Kuske, Rachel (UBC)
Meagher, Karen (University of Waterloo)
Mishna, Marni (SFU)
O'Hara, Kathleen (Mathematical Sciences Research Institute)
Quinn, Jennifer (University of Puget Sound)
Taylor, Jean (Courant Institute for Mathematical Sciences)
Taylor, Edward (Wesleyan University)
Tobias, Sheila (Author/Consultant)
Wiegand, Sylvia (University of Nebraska)
Wood, Carol (Wesleyan University)
Wood, Kathryn (BIRS)
Zhou, Ping (St. Francis Xavier University)

Mathematical Methods in Computer Vision
September 30 - October 5, 2006

Organizers:

Dana Cobzas (University of Alberta)
Anders Heyden (Malmo University, Sweden)
Martin Jagersand (University of Alberta)
Jim Little (University of British Columbia)
Peter Sturm (INRIA Rhone-Alpes)
Bill Triggs (GRAVIR-CNRS-INRIA)
Steve Zucker (Yale University).

Computer Vision is distinct from its sister disciplines in that it seeks to recover information (often 3D geometric) from it's 2D projection in images, while Graphics visualizes 2D images from known 3D models, and Image Processing enhances 2D images into modified 2D images. The inverse nature of the Computer Vision problem makes it harder than the two other, and it is only recently that e.g. methods from uncalibrated vision has turned into useful applications pursued by new companies, e.g. INRIA spinoff Realviz and Oxford University's 2D3. While Computer Graphics and Image Processing have longstanding mainstream use (dollars spent on computer games recently surpassed feature movies), Computer Vision only now stands at the brink of making mainstream impact. It was therefore fitting and timely to schedule a Computer Vision workshop in 2006 after the two successful workshops in 2004, Mathematical Image Processing and Visualization/Computer Graphics.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5085/

Participants:

Bergtholdt, Martin (University of Mannheim)
Birkbeck, Neil (University of Alberta)
Boykov, Yuri (University of Western Ontario)
Broadhurst, Adrien (Vicon Motion Systems)
Brown, Matthew (Microsoft Research)
Caenen, Geert (Katholieke Universiteit Leuven)
Cobzas, Dana (University of Alberta)
Fleet, David (University of Toronto)
Furukawa, Yasutaka (University of Illinois)
Hartley, Richard (Australian National University)
Hebert, Patrick (Laval University)
Heyden, Anders (Malmo University, Sweden)
Jagersand, Martin (University of Alberta)
Kahl, Fredrik (Lund University)
Kutulakos, Kyros (University of Toronto)
Lepetit, Vincent (EPFL)
Mori, Greg (SFU)
Nister, David (University of Kentucky)
Nyberg, Fredrik (Malmo)
Pollefeys, Marc (University of North Carolina)
Rachmielowski, Adam (University of Alberta)
Ranganathan, Ananth (Georgia Institute of Technology)
Rehg, Jim (Georgia Institute of Technology)
Roth, Stefan (Brown University)
Sinha, Sudipta (Universities of North Carolina, Chapel Hill)
Sminchisescu, Cristi (TTI-C/ University of Toronto)
Snavely, Noah (University of Washington)
Solem, Jan Erik (Malmo University)
Sturm, Peter (INRIA Rhone-Alpes)
Subbarao, Raghav (Rutgers University)
Szeliski, Richard (Microsoft Research)
Taubin, Gabriel (Brown University)
Torr, Philip (Oxford Brookes University)
Triggs, Bill (GRAVIR-CNRS-INRIA)
Urtasun, Raquel (MIT)
Vasilescu, M. Alex O. (MIT)
Vidal, Rene (Johns Hopkins University)
Zhang, Li (Columbia University)
Zickler, Todd (Harvard University)

Positive Polynomials and Optimization
October 7 - 12, 2006

Organizers:

Salma Kuhlmann (University of Saskatchewan)
Sanjay Lall (Stanford University)
Victoria Powers (Emory University)
Frank Sottile (Texas A&M University)

The aim of holding this workshop at this time was to continue a recent tradition of bringing researchers in optimization to gain access to the new mathematical tools related to positive polynomials. The conference was to give an opportunity for pure mathematicians to interact and exchange ideas/results with applied researchers in optimization. In a sense, the distinguishing property of the real numbers is positivity. There has been a recent explosion of interest in positive polynomials. This is due to the many interesting applications, the introduction of numerical algorithms for computing with sums of squares, as well as new theoretical results about sums of squares and representations of positive polynomials. Positive polynomials can be used to formulate problems in control theory, optimization, and other areas, and then these problems can be solved using the theory of positive polynomials coupled with numerical techniques from semidefinite programming.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5060

Participants:

Augustin, Doris (University of Regensburg)
Castle, Mari (Emory University)
Cimpric, Jaka (University of Ljubljana)
Curto, Raul (University of Iowa)
Gondard, Danielle (Universit'e Pierre et Marie Curie)
Helton, Bill (University of California, San Diego)
Hillar, Christopher (Texas A&M University)
Kuhlmann, Salma (University of Saskatchewan)
Lall, Sanjay (Stanford University)
Lasserre, Jean-Bernard (LAAS-CNRS)
Laurent, Monique (CWI Amsterdam)
Marshall, Murray (University of Saskatchewan)
Netzer, Tim (University of Konstanz)
Nie, Jiawang (University of California, Berkeley)
Papachristodoulou, Antonis (University of Oxford)
Parrilo, Pablo (MIT)
Pasechnik, Dmitrii (Dima) (Nanyang Technological University)
Pena, Javier (Carnegie Mellon University)
Plaumann, Daniel (University of Konstanz)
Powers, Victoria (Emory University)
Prestel, Alexander (Universitaet Konstanz)
Putinar, Mihai (University of California, Santa Barbara)
Renegar, James (Cornell University)
Reznick, Bruce (University of Illinois)
Roy, Marie-Francoise (Universit'e Rennes 1)
Scheiderer, Claus (Universität Konstanz)
Schmuedgen, Konrad (University of Leipzig)
Schwartz, Niels (Universität Passau, Germany)
Schweighofer, Markus (Universität Konstanz)
Sottile, Frank (Texas A&M University)
Theobald, Thorsten (Technische Universitaet Berlin)
Tuncel, Levent (University of Waterloo)
Wolkowicz, Henry (University of Waterloo)
Zinchenko, Yuriy (McMaster University)
Zuluaga, Luis (University of New Brunswick)

Syzygies and Hilbert Functions
October 14 - 19, 2006

Organizers:

Irena Peeva (Cornell University)

Mike Stillman (Cornell University)

Commutative algebra and algebraic geometry are the fields of mathematics which deal with understanding the solutions of a system of polynomial equations, possibly in a large number of variables and with a large number of equations. The solutions form a geometric object. Since the number of variables is often large, graphing is not possible. The main idea in these mathematical fields is to study the geometric properties using algebra. Syzygies and Hilbert functions are key techniques for understanding the structure of such geometric objects.

The workshop focused on the hottest new results on syzygies and Hilbert functions. There has been a surge in interest and research in this direction during the last years: a great variety of new ideas and techniques have been introduced, and substantial progress has been made. Projects in this direction have been undertaken by both established mathematicians and graduate students or postdocs. However, many central conjectures and open problems are very challenging and remain wide open. One of the main goals was to spark further interaction. The workshop was also an opportunity to focus on these problems and to explore new directions.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5082/

Participants:

Abo, Hirotachi (University of Idaho)
Altmann, Klaus (Freie Universitaet Berlin, Germany)
Avramov, Luchezar (University of Nebraska)
Bayer, Dave (Barnard College)
Bruns, Winfried (University of Osnabruck)
Caviglia, Giulio (UC-Berkeley)
Chardin, Marc (CNRS\Université Pierre et Marie Curie)
Christensen, Lars Winther (University of Nebraska-Lincoln)
Conca, Aldo (University of Genova)
Cooper, Susan (California Polytechnic State University)
Cutkosky, Steven Dale (University of Missouri-Columbia)
Eisenbud, David (Msri/UC-Berkeley)
Elias, Juan (University of Barcelona Spain)
Floystad, Gunnar (University of Bergen, Norway)
Francisco, Chris (University of Missouri)
Gold, Leah (Cleveland State University)
Harbourne, Brian (University of Nebraska-Lincoln)
Hibi, Takayuki (Osaka University)
Horwitz, Noam (Cornell University)
Huneke, Craig (University of Kansas)
Iyengar, Srikanth (University of Nebraska, Lincoln)
Kummini, Manoj (University of Kansas)
Mermin, Jeff (Cornell University)
Migliore, Juan (University of Notre Dame)
Moore, Frank (University of Nebraska)
Nagel, Uwe (University of Kentucky)
Noma, Atsushi (Yokohama National University, Japan)
Peeva, Irena (Cornell University)
Peterson, Chris (Colorado State University)
Popescu, Sorin (Stony Brook University)
Reiner, Victor (University of Minnesota)
Richert, Ben (California Polytechnic State University)
Schenck, Hal (Texas A&M University)
Smith, Gregory G. (Queen's University)
Srinivasan, Hema (University of Missouri)
Stillman, Mike (Cornell University)
Tchernev, Alexandre (State University of New York, Albany)
Trivedi, Vijaylaxmi (Tata Institute of Fundamental Research India)
Van Tuyl, Adam (Lakehead University)
Velasco, Mauricio (Cornell University)
Veliche, Oana (University of Utah)
Welker, Volkmar (Philipps-Universitaet Marburg)

Topological Graph Theory and Crossing Numbers
October 21 - 26, 2006

Organizers:

Bojan Mohar (Simon Fraser University)
Janos Pach (Courant Institute and City College)
Bruce Richter (University of Waterloo)
Robin Thomas (Georgia Institute of Technology)
Carsten Thomassen (Technical University of Denmark)

The main objective of this workshop was to bring together two groups of researchers, those working in topological graph theory and graph minors, and those working with crossing numbers. Both areas have developed methods, mathematical tools and powerful results that have great potential for being used in the other area. For instance, the most basic open problem about crossing numbers is the Turan's Brickyard problem. Would it be possible to use results about the genus of graphs and graph minors to get some new insight into this problem? On the other hand the study of crossing numbers of graphs on nonsimply connected surfaces may yield new results of interest for the topological graph theory.

Some survey lectures were organized where best mathematicians from both areas will present the current state of the art of the theory. Additionally, there would be corresponding problem sessions with intention to motivate the participants to apply their knowledge towards problems in the other area.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5067/

Participants:

Ackerman, Eyal (SFU)
Albertson, Mike (Smith College)
Bokal, Drago (University of Waterloo)
Bruhn, Henning (Universität Hamburg)
Cabello, Sergio (University of Ljubljana)
Christian, Robin (University of Waterloo)
Debowsky, Marisa (Courant Institute)
DeVos, Matt (SFU)
Ebrahimi Boroojeni, Javad (SFU)
Ellingham, Mark (Vanderbilt University)
Fox, Jacob (Princeton)
Goddyn, Luis (SFU)
Hajiaghayi, MohammadTaghi (Carnegie Mellon University)
Hlineny, Petr (Masaryk University)
Hutchinson, Joan (Macalester College)
Kawarabayashi, Ken-ichi (National Institute of Informatics)
Kral, Daniel (Charles University)
Mohar, Bojan (SFU)
Norine, Serguei (Georgia Tech/ DE Shaw & Co)
Oum, Sang-il (Georgia Institute of Technology)
Pach, Janos (Courant Institute and City College)
Pelsmajer, Michael (Illinois Institute of Technology)
Pikhurko, Oleg (Carnegie Mellon University)
Pinchasi, Rom (Technion-Israel Institute of Technology)
Richter, Bruce (University of Waterloo)
Robertson, G. Neil (Ohio State University)
Salazar, Gelasio (Universidad Autonoma de San Luis Potosi)
Schaefer, Marcus (DePaul University)
Shahrokhi, Farhad (University of North Texas)
Solymosi, Jozsef (UBC)
Song, Zixia (University of Central Florida)
Szekely, Laszlo (University of South Carolina)
Tardos, Gabor (SFU)
Thomas, Robin (Georgia Institute of Technology)
Thomassen, Carsten (Technical University of Denmark)
Vodopivec, Andrej (University of Ljubljana)
Yerger, Carl (Georgia Institute of Technology)

Hyperbolic Systems of Conservation Laws and Related Problems
October 28 - November 2

Organizers:

Gui-Qiang Chen (Northwestern University)
Walter Craig (McMaster University)
Constantine Dafermos (Brown University)
Konstantina Trivisa (University of Maryland)

This workshop on hyperbolic conservation laws and related problems focused on mathematical problems for compressible flows in fluid dynamics, combustion, oceanography, astrophysics, particle physics, and other areas. The models are formulated by the equations of Euler and Navier-Stokes for compressible fluids, MHD, Euler-Poisson, and other.

The aim was to bring together analytical and numerical experts of the applied mathematics community in order to take part in the examination of emerging problems, exchanging ideas in a structured and focused environment. We also included in the group of participants a significant number of young researchers and graduate students in an effort to encourage them to study applied mathematics and to choose it as a career. Holding the workshop at BIRS was especially conductive to attracting the broadest possible international audience.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5046/

Participants:

Ancona, Fabio (University of Bologna)
Chen, Gui-Qiang (Northwestern University)
Christoforou, Cleopatra (Northwestern University)
Craig, Walter (McMaster University)
Dafermos, Constantine (Brown University)
Elling, Volker (Brown University)
Feldman, Mikhail (University of Wisconsin)
Fetecau, Razvan (SFU)
Frid, Hermano (IMPA, Brasil)
Ghoussoub, Nassif (BIRS/ UBC)
Hoff, David (Indiana University)
Holden, Helge (NTNU Trondheim)
Jabin, Pierre-Emmanuel (University of Nice, France)
Jenssen, Kris (Pennsylvania State University)
Keyfitz, Barbara Lee (Fields Institute/University of Houston)
Kim, Eun Heui (California State University at Long Beach)
Klingenberg, Christian (University of Wuerzburg, Germany)
Kroener, Dietmar (University of Freiburg)
Li, Tong (University of Iowa)
Liu, Tai-Ping (Stanford University)
Luo, Tao (Georgetown University)
McCann, Robert (University of Toronto)
Pan, Ronghua (Georgia Institute of Technology)
Panferov, Vladislav (McMaster University)
Rascle, Michel (University of Nice)
Shearer, Michael (North Carolina State University)
Slemrod, Marshall (University of Wisconsin)
Sospedra-Alfonso, Reinel (University of Victoria)
Spinolo, Laura Valentina (Northwestern University)
Torres, Monica (Purdue University)
Trivisa, Konstantina (University of Maryland)
Tzavaras, Athanasios (University of Maryland)
Westdickenberg, Michael (Rheinische Friedrich-Wilhelms-Universitaet)
Zhang, Yongqian (Fudan University)
Zheng, Yuxi (Pennsylvania State University)
Zhu, Dianwen (University of Maryland)

Random Media
November 4 - 9, 2006

Organizers:

Martin Barlow (University of British Columbia)
Erwin Bolthausen (Universität Zürich)
Alain-Sol Sznitman (ETH Zürich)

This workshop came at a time where a number of progresses in the Random Media areas were taking place. Several mutual links between the fields are also becoming apparent. The hope was that the workshop by bringing together well-known mathematicians and mathematical physicists working on these different subjects would foster synergies between these fields, where in the last few years substantial progress has been made on some long standing open problems.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5102/

Participants:

Aizenman, Michael (Princeton University)
Alexander, Ken (University of Southern California)
Angel, Omer (University of Toronto)
Barlow, Martin (UBC)
Berestycki, Nathanaël (UBC)
Berger, Noam (UCLA)
Biskup, Marek (UCLA)
Bolthausen, Erwin (Universität Zürich)
Bovier, Anton (Weierstrass Institute for Applied Analysis and Stochastics, Berlin)
Bremont, Julien (Université de Paris 12)
Cheliotis, Dimitris (University of Toronto)
Comets, Francis (Universite Paris 7)
Contucci, Pierluigi (Universita di Bologna)
Gaertner, Juergen (Technical University Berlin)
Giacomin, Giambattista (Universite Paris 7)
Goldsheid, Ilya (Queen Mary, University of London)
Goodman, Jesse (UBC)
Holmes, Mark (Eurandom)
Jarai, Antal (Carleton University)
Kumagai, Takashi (RIMS Kyoto)
Kurchan, Jorge (ENS Lab. de Phys. Theorique Paris)
Merkl, Franz (University of Munich)
Newman, Charles M. (New York University)
Olla, Stefano (CEREMADE - Université Paris Dauphine)
Osada, Hirofumi (Kyushu University)
Ramirez, Alejandro (Pontificia Universidad Catolica de Chile)
Rassoul-Agha, Firas (University of Utah)
Roitershtein, Alexander (UBC)
Rolles, Silke (Eindhoven University of Technology)
Schmitz, Tom (ETH Zurich/ UCLA)
Seppalainen, Timo (University of Wisconsin)
Sidoravicius, Vladas (IMPA Rio de Janeiro)
Slade, Gordon (UBC)
Sznitman, Alain-Sol (ETH Zürich)
Tarres, Pierre (Oxford University)
Toninelli, Fabio (ENS Lyons)
Virag, Balint (University of Toronto)
Volkov, Stanislav (University of Bristol)
Warzel, Simone (Princeton University)
Zeitouni, Ofer (University of Minnesota)
Zerner, Martin (University of Tuebingen)

Optimization and Engineering Applications
November 11 - 16, 2006

Organizers:

Jiming Peng (University of Illinois at Urbana-Champaign)
Tamás Terlaky (McMaster University)
Robert Vanderbei (Princeton University)
Henry Wolkowicz (University of Waterloo)
Yinyu Ye (Stanford University)

Optimization is a subject that deals with the problem of minimizing or maximizing a certain functions over a set of feasible solutions that is usually determined by functional inequalities. During the past century, optimization has been developed into a mature field that has endless opportunities to positively impact the quality, efficiency of engineering and may result in huge economic benefits. Various branches of the field of optimization have sound theoretical foundation and are featured by extensive collection of sophisticated algorithms and software tools that enable us to tackle real problems in size and complexity that were beyond reality even a decade ago.

Starting in the middle 1980's, the field of optimization has experienced a revolutionary development, in particular in the area of convex optimization. This was sparked by Karmarkar's ground-breaking work on interior-point methods (IPMs) for linear optimization, and later accomplished by many excellent optimization experts. The IPM revolution has brought new theoretical and practical powerful tools for solving large classes of optimization problems and led to new research areas. The workshop brought together leading experts from the mathematical and engineering optimization communities to review state of the art, to identify challenges and burning engineering problems that require novel optimization methodologies.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5081/

Participants:

Adler, Ilan (University of California, Berkeley)
Anjos, Miguel F. (University of Waterloo)
Behjat, Laleh (University of Calgary)
Betts, John (Boeing)
Brown, David (Duke University)
Chen, Lifeng (Columbia University)
Chiang, Mung (Princeton University)
Conn, Andrew R. (IBM)
d'Aspremont, Alexandre (Princeton University)
Ding, Yichuan (University of Waterloo)
Duer, Mirjam (T.U. Darmstadt)
Ferris, Michael C. (University of Wisconsin)
Freund, Robert M. (MIT)
Gao, David Yang (Virginia Tech)
Goldfarb, Donald (Columbia University, New York)
Grodzevich, Oleg (University of Waterloo)
Jarre, Florian (University of Duesseldorf)
Kostina, Ekaterina (University of Heidelberg)
Krislock, Nathan (University of Waterloo)
Luo, Zhi-Quan (University of Minnesota)
Marlin, Tom (McMaster University)
Martins, Joaquim R. R. A. (University of Toronto)
Moré, Jorge (Argonne)
Nematollahi, Eissa (McMaster University)
Nie, Jiawang (University of California, Berkeley)
Ozdaglar, Asu (MIT)
Peng, Jiming (University of Illinois at Urbana-Champaign)
Pinter, Janos (Pinter Consulting Services, Inc.)
Polik, Imre (McMaster University)
Richtarik, Peter (Cornell University)
Savard, Gilles (Ecole Politechnic Montréal)
Terlaky, Tamás (McMaster University)
Toh, Kim-Chuan (National University of Singapore)
Tseng, Paul (University of Washington)
Vanderbei, Robert (Princeton University)
Visweswariah, Chandu (IBM, Thomas J. Watson Research Center)
Wild, Stefan (Cornell University)
Wolkowicz, Henry (University of Waterloo)
Yu, Wei (University Toronto)
Zhang, Shuzhong (Chinese University of HongKong)
Zhang, Hu (McMaster University)
Zhang, Yin (Rice University)

Polynomials over Finite Fields and Applications
November 18 - 23, 2006

Organizers:

Ian Blake (University of Toronto)
Stephen Cohen (University of Glasgow)
Gary Mullen (Pennsylvania State University)
Daniel Panario (Carleton University)

Finite fields are finite sets of objects which have an arithmetic that allows the usual operations of addition, subtraction, multiplication, and division, except that contrary to the real numbers, the set contains only a finite number of distinct elements. The workshop focused on new results and methods in the study of various kinds of polynomials over finite fields. Finite fields are not only of deep mathematical interest in their own right but also play a critical role in modern information theory including algebraic coding theory for the error-free transmission of information and cryptology for the secure transmission of information. Polynomials over finite fields play an essential role in these and other very practical and important technologies; thus the emphasis of the workshop on various aspects related to polynomials with coefficients in finite fields.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5021/

Participants:

Ahmadi, Omran (University of Toronto)
Arikushi, Karin (Carleton University)
Bernstein, Daniel (University of Illinois, Chicago)
Blake, Ian (University of Toronto)
Bluher, Antonia (National Security Agency)
Car, Mireille (Universite Paul Cezanne, Aix-Marseille III)
Coulter, Robert (University of Delaware)
Dewar, Michael (University of Illinois, Urbana-Champaign)
Dillon, John (National Security Agency)
Enge, Andreas (Ecole polytechnique, Paris)
Gallardo, Louis (L'Universite de Bretagne Occidentale)
Gao, Shuhong (Clemson University)
Garcia, Arnaldo (IMPA)
Garefalakis, Theo (University of Crete)
Gathen, Joachim on zur (B-IT, University of Bonn, Germany)
Gong, Guang (University of Waterloo)
Hirschfeld, James (University of Sussex)
Huczynska, Sophie (University of St Andrews)
Lange, Tanja (Technische Universiteit Eindhoven)
Lenstra, H.W. (University of Leiden)
Li, Winnie (Pennsylvania State University)
Lisonek, Petr (SFU)
Masuda, Ariane (Carleton University)
McGuire, Gary (University College Dublin)
Mills, Don (Rose-Hulman Institute of Technology)
Moisio, Marko (University of Vaasa, Finland)
Mullen, Gary (Pennsylvania State University)
Panario, Daniel (Carleton University)
Park, Jang-Woo (Clemson University)
Presern, Mateja (Univeristy of Glasgow)
Ranto, Kalle (University of Turku)
Ruskey, Frank (University of Victoria)
Semaev, Igor (University of Bergen)
Shparlinski, Igor (Macquarie University)
Tapia-Recillas, Horacio (Universidad Autonoma Metropolitana-Iztapalapa)
Thomson, David (Carleton University)
Voloch, Jose Felipe (University of Texas at Austin)
Wan, Daqing (University of Calirfornia, Irvine)
Wang, Qiang (Carleton University)
Yucas, Joe (Southern Illinois University)
Zieve, Michael (IDA Center for Communications Research)

Modelling and Mining of Networked Information Spaces - MITACS
November 25 - 29, 2006

Organizers:

Bill Aiello (University of British Columbia)
Andrei Broder (Yahoo! Inc.)
Jeannette Janssen (Dalhousie University)
Evangelos Milios (Dalhousie University)

Gaining insight into the structure of large networked information spaces is one of the major challenges of current research. The prime example of a networked information space is the World Wide Web: a “library” of information-bearing Web pages which are connected by hyperlinks. Other examples are the scholarly literature of a given field, or case law, linked by references. Complex networks such as the dynamic networks formed by email exchanges or phone calls between individuals are of related interest.

The objective of this workshop was to familiarize a new generation of researchers with the tools and techniques that are being developed to confront this challenge. These techniques are drawn from different fields such as: graph theory, machine learning, natural language processing, and stochastic modeling.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5104/

Participants:

Aiello, Bill (UBC)
Angelova, Ralitsa (Max Planck Institute for Informatics)
Awekar, Amit (North Carolina State University)
Barouni-Ebrahimi, Mohammadreza (University of New Brunswick)
Broder, Andrei (Yahoo! Inc.)
Chakrabarti, Soumen (IIT Bombay)
Chung Graham, Fan (University of California at San Diego)
Gurevich, Maxim (Technion)
Healy, John (Dalhousie University)
Horn, Paul (University of California, San Diego)
Janssen, Jeannette (Dalhousie University)
Kanovsky, Igor (Max Stern Ac. Coll.)
Kasneci, Gjergji (Max Planck Institute)
Liben-Nowell, David (Carleton College)
Litvak, Nelly (Universiteit Twente)
McKay, Neil (Dalhousie University)
Meiss, Mark (Indiana Univeristy)
Menczer, Filippo (Indiana University)
Milios, Evangelos (Dalhousie University)
Mizoguchi, Yoshihiro (Kyushu University)
Nargis, Isheeta (Memorial University of Newfoundland)
Okada, Koji (Kyushu University)
Olsen, Martin (University of Aarhus)
Pralat, Pawel (Dalhousie University)
Richardson, Ross M. (University of California, San Diego)
Shafiei, Mahdi (Dalhousie University)
Tanaka, Takahiro (Kyushu University)
Tanta-ngai, Hathai (Dalhousie University)
Thomas, Dilys (Stanford University)
Vlachou, Akrivi (Athens University of Economics & Business)
Wan, Xiaomeng (Dalhousie University)
Wang, Tao (University of Alberta)
Willinger, Walter (AT&T Labs-Research)
Yasar, Oznur (Memorial University)
Zhou, Bin (SFU)

Operator Methods in Fractal Analysis, Wavelets and Dynamical Systems
December 2 - 7, 2006

Organizers:

Ola Bratteli (University of Oslo)
Palle Jorgensen (The University of Iowa)
David Kribs (University of Guelph)
Gestur Olafsson (Louisiana State University)
Sergei Silvestrov (Lund University)

Recently our understanding of some of the most exciting new scientific discoveries has proved to rely on fractal features. They are understood by the coming together of mathematics, communication theory, computer graphics, signal/image processing, medical imaging, and quantum theory.

Leading researchers from around the world gathered at BIRS and focused on the hottest new results in fractal theory and related topics. Fractals are everywhere in nature and in technology. When you look at them in a microscope or in a telescope, you see hidden patterns as similar repeated structures and features, repeated at different scales. On occasion they are well hidden, for example in huge data sets from the internet. Fractal analysis and data mining are the tools that reveal these features, repeated at varying scales of resolution; and making up fundamental constituents in a yet new and relatively uncharted domain of science. The workshop brought together experts in areas of pure and applied mathematics who have made independent advances; and the workshop would be a unique opportunity for advancing the field through teamwork and collaboration.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5027/

Participants:

Boca, Florin (University of Illinois, Urbana)
Bodmann, Bernhard (University of Waterloo)
Brenken, Berndt (University of Calgary)
D'Andrea, Jonas (University of Colorado at Boulder)
Davidson, Ken (University of Waterloo)
de Jeu, Marcel (Leiden University - Holland)
Dutkay, Dorin (Rutgers University)
Eilers, Soren (University of Copenhagen)
Giordano, Thierry (University of Ottawa)
Groechenig, Karl-Heinz (University of Vienna)
Ivan, Cristina (University of Hannover)
Johansen, Rune (University of Copenhagen)
Jorgensen, Palle (The University of Iowa)
Katsoulis, Elias (East Carolina University)
Katsura, Takeshi (Hokkaido University)
Kribs, David (University of Guelph)
Laca, Marcelo (University of Victoria)
Lamoureux, Michael (University of Calgary)
Larsen, Nadia S. (University of Oslo)
Larson, David (Texas A&M University)
Lesosky, Maia (University of Guelph)
Massopust, Peter (GSF - Institute for Biomathematics and Biometry/ Technical University, Munich)
Mohari, Anilesh (N. Bose Centre for Basic Sciences, India)
Neshveyev, Sergey (University of Oslo)
Nikolaev, Igor (University of Calgary)
Niu, Zhuang (University of Calgary)
Oinert, Johan (Lund University - Sweden)
Olafsson, Gestur (Louisiana State University)
Packer, Judith (University of Colorado)
Phillips, N. Christopher (University of Oregon)
Putnam, Ian (University of Victoria)
Raeburn, Iain (University of Newcastle - Australia)
Roysland, Kjetil (University of Oslo)
Ruskai, Mary Beth (Tufts University)
Sangha, Amandip (University of Oslo)
Silvestrov, Sergei (Lund University)
Skau, Christian (NTNU - Trondheim - Norway)
Song, Myung-Sin (Southern Illinois University Edwardsville)
Strungaru, Nicolae (University of Victoria)
Svensson, Christian (Lund University, Sweden / Leiden University, The Netherlands)
Tomiyama, Jun (Tokyo Metropolitan University)
Whittaker, Michael (University of Victoria)

Numerical Methods for Degenerate Elliptic Equations and Applications
December 9 - 14, 2006

Organizers:

Doron Levy (Stanford University)
Ian Mitchell (University of British Columbia)
Adam Oberman (Simon Fraser University)
Panagiotis Souganidis (University of Texas, Austin)

Degenerate elliptic partial differential equations occur widely in many branches of applied math and engineering. The theory of viscosity solutions has been enormously successful in addressing the problems of existence, uniqueness and stability of solutions for this class of equations under minimal regularity requirements. Until recently, however, there has been much less success constructing solutions for many practical examples. The development of techniques for effectively computing solutions to degenerate elliptic equations could have a huge impact in these application areas.
What stands in the way of developing effective computational techniques? The biggest obstacle is the high dimensionality of the domains on which practical problems must be solved. For example, the Hamilton-Jacobi-Bellman equations for optimal flight trajectories evolve on an underlying space of at least six dimensions. Stochastic control problems from mathematical finance may have twenty dimensions. New techniques need to be developed which overcome this obstacle. Applied mathematicians and numerical analysts with expertise in the field of viscosity solutions and a collection of carefully chosen application area experts whose research is impacted by viscosity solutions gathered together at the BIRS workshop.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w5095/

Participants:

Alton, Kenneth (UBC)
Bourlioux, Anne (Université de Montréal)
Carlini, Elisabetta (Università La Sapienza)
Chertock, Alina (North Carolina State University)
Chung, Eric (California Institute of Technology)
Claudel, Christian (Institut National de Recherche sur les Transports et leur Securite)
Cross, Elizabeth (UBC)
Ferretti, Roberto (Università degli Studi di Roma Tre)
Gomes, Diogo (Instituto Superior Tecnico)
Kao, ChiuYen (University of Minnesota)
Kurganov, Alexander (Tulane University)
Leung, Shingyu (UCLA)
Levy, Doron (Stanford University)
Li, Fengyan (Rensselaer Polytechnic Institute)
Mitchell, Ian (UBC)
Oberman, Adam (SFU)
Paquin, Dana (Stanford University)
Qian, Jianliang (Wichita State University)
Ruuth, Steven (SFU)
Saint-Pierre, Patrick (University Paris Dauphine)
Sethian, James (University of California, Berkeley)
Takei, Ryo (SFU)
Tsai, Richard (University of Texas, Austin)
Vladimirsky, Alexander (Cornell University)
Zhao, Hongkai (UC Irvine)

Banff International Research Station

2006

2-Day Workshops

Math Fair Workshop
April 20 - 22, 2006

Organizers:

Tiina Hohn (Grant MacEwan College)

Ted Lewis (University of Alberta)

This was the fourth BIRS math fair workshop, which is becoming a popular annual event. The participants came from elementary schools, junior-high and high schools, from independent organizations, and from universities and colleges. The thirty-six participants at this year's workshop were educators of all types, from teachers to grad students to expert puzzle and game creators.

The purpose of the workshop was to bring together educators who are interested in using our particular type of math fair, called a SNAP math fair, to enhance the mathematics curriculum. (The name SNAP is an acronym for the guiding principles of this unconventional type of math fair: It is student-centered, non-competitive, all-inclusive, and problem-based.) The projects at a SNAP math fair are problems that the students present to the visitors. In preparation, the students will have solved chosen problems, rewritten them in their own words, and created hands-on models for the visitors. At a SNAP math fair, all the students participate, and the students are the facilitators who help the visitors solve the problems. This process of involving students in fun, rich mathematics is the underlying vision that makes the SNAP program so unique and effective. No first prize! No arguments about judging! Everyone is a winner!".

At the BIRS workshop, the participants learn about and try math-based puzzles and games that they can use in the classroom. They have a chance to see how other teachers have organized math fairs at their schools, how the SNAP math fair fits the curriculum, and what some schools have done for follow-ups. And then they go back to their schools and change the culture of mathematics in their class-room.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06w2319/

Participants:

Beisiegel, Mary (University of Alberta)
Bosscha, Angela (Edmonton Public Schools)
Burke, Joan (Calgary Schools)
Charters, Julie (Edmonton Public Schools)
Chasse, Danielle (Our Lady of the Prairies)
Chernishenko, Kelly (Edmonton Public Schools)
Christensen, Derek (Edmonton Public Schools)
Craven, Jodie (Talmud Torah School)
Desaulniers, Shawn (University of Alberta)
Godwaldt, Terry (Edmonton Public Schools)
Gordon, Christie (Olympic Heights Elementary)
Graves, Sean (University of Alberta)
Hamilton, Gordon (Masters Academy and College)
Herwig, Brooke (Foundations for the Future Charter Academy)
Hohn, Tiina (Grant MacEwan College)
Hudani, Salima (Foundations for the Future Charter School)
Isaac, Vince (Annunciation)
Leblanc, Isabelle (Edmonton Catholic School District)
Lee, Jennifer (Edmonton Catholic School District)
Lewis, Ted (University of Alberta)
Livingstone, Kate (Calgary Schools)
MacKay, Lorraine (BC schools)
Marinova, Rossitza (Concordia University College of Alberta)
Mineva, Victoria (University of Alberta)
Pederson, Claudia (Edmonton Catholic Schools)
Poscente, Krista (University of Calgary)
Serate, Hope (University of Calgary)
Shaw, Dolph (Edmonton Public Schools)
Sorenson, Wendy (Edmonton Public Schools)
Teixeira, Nadene (Edmonton Schools)
Wang, Qian (University of Alberta)
Watz, Tammy (Edmonton Catholic School District)

Banff International Research Station

2006

Summer Schools

Research In Teams

Focused Research Groups

PIMS/UNAM Algebra Summer School
July 1 - 6, 2006

Organizers:

Alejandro Adem (University of British Columbia)
James Carrell (University of British Columbia)
Jose Antonio de la Pena (Universidad Nacional Autonoma de Mexico)

Recent developments consider geometric objects associated to module categories, such as varieties of algebras and modules, semi-stable representations and their moduli spaces. These topics require the use of tools of Algebraic Geometry, which relates with many branches of mathematics, such as, differential geometry, topology, number theory, analysis and differential equations. It is worth mentioning that the modern approach to the problem of classifying varieties involves classifying all possible embeddings into projective spaces. Homological methods in representation theory have also had important successes, where methods from the cohomology of finite groups are applied to understanding basic properties of modular representations, as well as for obtaining explicit calculations. In particular there has been recent progress in classifying endo-trivial modules using these methods. Representation theory has proved equally important in the realm of infinite dimensional algebras, where it has long been utilized to linearize the study of objects such as infinite groups or differential operators. It has led, in particular, to the study of algebras with multiplicative twists, which have played key role the development of quantum groups. The algebraic side of this field includes the study of the noncommutative version of classical algebraic geometry.

The PIMS/UNAM Algebra Symposium had the goal of bringing together researchers from Canada, Mexico and the United States involved in areas of algebra which touch upon the themes outlined above. This led to important interactions between PIMS researchers already involved in a Collaborative Research Group (CRG), as well as helping establish a significant connection to the highly regarded algebra community in Mexico.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06ss100/

Participants:

Adem, Alejandro (UBC)
Assem, Ibrahim (Université de Sherbrooke)
Avella Alaminos, Diana (UNAM)
Babson, Eric (University of Washington)
Barot, Michael (UNAM)
Bautista, Raymundo (UNAM)
Behrend, Kai (UBC)
Bell, Jason (SFU)
Bruin, Nils (SFU)
Cliff, Gerald (University of Alberta)
Combariza, German (UBC)
Cunningham, Clifton (University of Calgary)
de la Pena, Jose Antonio (UNAM)
Dugas, Alexander (UC-Berkeley)
Duncan, Alexander (UBC)
Elizondo, E. Javier (UNAM)
Garcia-Villa, Clotilde (UNAM)
Geiss, Christof (UNAM)
Goodearl, Ken (UC-Santa Barbara)
Huisgen-Zimmermann, Birge (UC-Santa Barbara)
Juan-Pineda, Daniel (UNAM)
Kovacs, Sandor (University of Washington)
Kuttler, Jochen (University of Alberta)
Lewis, James (University of Alberta)
Martinez-Villa, Roberto (UNAM)
Mendoza, Octavio (UNAM)
Meyer, Aurel (UBC)
Ondrus, Alex (University of Alberta)
Pianzola, Arturo (University of Alberta)
Raggi Cardenas, Gerardo (UNAM)
Smith, Paul (University of Washington)
Sun, Jie (University of Alberta)
Valencia, Carlos (UNAM)
Wen, Qianglong (University of Alberta)
Zhang, James (University of Washington)
Zuazua, Rita (UNAM)

Research In Teams

Saari's Conjecture
February 11 - 25, 2006

Organizers:

Florin Diacu (University of Victoria)
Ernesto Perez (UAM-I Mexico)
Manuele Santoprete (University of California, Irvine)

The Diacu/Perez-Chavela/Santoprete team has been recently joined by Toshiaki Fujiwara of Japan. Fujiwara suggested a new formalism, based on complex functions, that sheds a new light on Saari's conjecture. At this point we had obtained several partial results, but the general framework is still missing. The reason for meeting together in Banff for two weeks would be find a common ground and to finalize this project.

Our detailed goals were:
-- to finalize the zero-angular momentum case of Saari's conjecture
-- to fill in the details for several partial results we have already obtained
-- to reveal the connections between Saari's conjecture and Smale's 6th problem
-- to design a strategy for attacking the generalized Saari conjecture

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit303/

Participants:

Diacu, Florin (University of Victoria)
Fujiwara, Toshiaki (Kitasato University)
Perez, Ernesto (UAM-I Mexico)
Santoprete, Manuele (UC-Irvine)

Partial Unconditionality in Banach Spaces
March 4 - 18, 2006

Organizers:

Thomas Schlumprecht (Texas A&M University)

The problem of partial unconditionality, namely does there exist a K so that given any weakly null normalized sequence (x_n) in a Banach space and a $d>0$, some subsequence is Elton unconditional for d with constant K, touches many areas of mathematics. One such area is that of discrete approximation: given a normalized sequence, when can one be assured that every element of the space can be well approximated by a finite linear combination of the elements with coefficients chosen from a discrete alphabet? It is easy to see that the unit vector basis of c_0 has this property. In fact this property played a key role in W.T.Gowers' proof that c_0 satisfies "the ultimate Ramsey property". However other bases also possess this property as witnessed by use of the sigma-delta algorithm in signal processing applied to the summing basis. We were able to verify however that an unconditional basis with the discrete approximation property which is Elton unconditional must be the c_0 basis. This then led us to a study of such bases.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit099/

Participants:

Dilworth, Stephen (University of South Carolina)
Odell, Edward (University of Texas, Austin)
Schlumprecht, Thomas (Texas A&M University)
Zsak, Andras (University of Cambridge)

Multi-Parameter Nehari Theorems
March 18 - 25, 2006

Organizers/ Participants:

Michael Lacey (Georgia Institute of Technology)
Stefanie Petermichl (University of Texas, Austin)
Jill Pipher (Brown University)
Brett Wick (Vanderbilt University)

The results of Ferguson, Lacey and Terwilleger were sought after for some time. The analytic methods employed have not as of yet found a wide set of applications, due to the unexpected difficulties of the proof. For instance, to understand the proof, one must be familiar with multi-parameter harmonic analysis of Alice Chang and Robert Fefferman, along with subsequent contributions of Journe. The multi-parameter theory of paraproducts plays an integral role, as do the equivalent formulations of the Theorem.

The team is actively pursuing variants of this result, problems and questions with significant contact in operator theory and harmonic analysis. These projects should lead to a deeper understanding of the methods and a broader dissemination of the methods.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit302/

Homology Stability of Moduli of Vector Bundles over a Curve
April 8 - 22, 2006

Organizers:

Donu Arapura (Purdue University)
Ajneet Dhillon (University of Western Ontario)
Pramathanath Sastry (University of Toronto)

We have implemented some of the known recurrence formulas [Z] for ranks of the cohomology groups (i.e. Betti numbers) of the moduli spaces of vector bundles over a curve on a computer. Based on our calculations, we conjecture the following: As the rank grows with genus fixed, the ith the cohomology groups should stabilize. The goal of our project would be to prove that this is the case, and to extract some corollaries. We expect that the comparison isomorphisms between moduli spaces or stacks would be given by algebraic correspondences, and in particular that they would be algebro-geometric in nature. This would ensure compatibility with the underlying motive, and in particular with Hodge and Galois module structures on cohomology.

One of the key consequences of the stability conjecture would be the existence of certain natural operations on these cohomology groups which would further elucidate their structure. The model for this is the cohomology of the moduli of line bundles over a curve. In this case, the moduli space can be identified with its Jacobian, and the addition law on the Jacobian leads to a Hopf algebra structure on its cohomology ring, from which its structure becomes apparent: it is an exterior algebra. In general, these operations would correspond to maps between the moduli spaces induced by tensor product and symmetric powers of the underlying vector bundles. The stability conjecture would allow us to identify the cohomology of the source and target.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit100/

Participants:

Arapura, Donu (Purdue University)
Dhillon, Ajneet (University of Western Ontario)

Curvature and Instability of Flows of Ideal Incompressible Fluid
May 20 - 27, 2006

Organizers:

Alexander Shnirelman (CRC, Concordia University, Montreal)

The stability theory of flows of ideal incompressible fluid is a testfield of all new ideas and methods of mathematical fluid dynamics. One of these approaches which has lead already to deep results is the study of fluid flows from the viewpoint of infinite-dimensional differential geometry. Ideal incompressible fluid inside a bounded domain M is an example of an infinite-dimensional Lagrangian system. Without external forces it moves along geodesics on the group *SDiff(M)* of volume-preserving diffeomorphisms of M, which is an infinite-dimensional Riemannian manifold. Hence, the stability of the flows should be connected with the Riemannian curvature of *SDiff(M)* , as it was pointed out by V.Arnold. However, the question is far from certain.

The differential geometry of *SDiff(M)* is complicated enough. The curvature can assume either signs and be zero, depending on the direction. The space *SDiff(M)* is homogeneous, but it is not symmetric. To the contrary, it is extremely far from symmetry. Therefore our ''symmetric'' intuition may be misleading, and in some situations negative curvature can stabilize the flow, if it varies in certain way. Likewise, positive curvature can be destabilizing. Directions of zero curvature and asymptotically flat geodesic subspaces should play important role in the stability and in the long time behavior of the flows.

The goal of the proposed program was the discussion and joint work on the interconnections between the stability of fluid flows and the curvature and, possibly, other differential-geometric properties of the configuration space *SDiff(M)* of ideal incompressible fluid.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit311/

Participants:

Ebin, David (SUNY at Stony Brook)
Misiolek, Gerard (University of Notre Dame)
Preston, Stephen (SUNY at Stony Brook)
Shnirelman, Alexander (CRC, Concordia University)

A Dynamical Approach to Rigidity of Automorphisms
June 24 - July 1, 2006

Organizers:

Alex Furman (University of Illinois Chicago)
Barak Weiss (Ben Gurion University)

In the recent workshop “Rigidity, dynamics and group actions” at BIRS (July 2005) it was realized by the applicants that the dynamical approach, using the work of Gorodnik-Weiss, could give alternative proofs of some of the results of Shalom-Steger and Furman, weakening some of the hypotheses. In fact, we strongly believe that it will be possible to apply the techniques developed by Gorodnik and Weiss to obtain many new results classifying Gamma maps between homogeneous spaces (generalizing the results of Shalom, Steger and Furman), and possibly also classifying general Gamma-factors of homogeneous varieties (generalizing results of Margulis, Dani and others).

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit307/

Participants:

Bader, Uri (University of Chicago)
Furman, Alex (University of Illinois Chicago)
Gorodnik, Alexander (California Institute of Technology)
Weiss, Barak (Ben Gurion University)

Inflation from String Theory
July 8 - 22, 2006

Organizers:

James Cline (McGill University)

The theory of brane-antibrane inflation is still in its early stages of development. In its present form it suffers from a fine-tuning problem: for generic values of parameters, such as the 3-form fluxes, inflation is nonexistent or too short-lived. Various parameters must be tuned to a part in 1000 to obtain the required amount of inflation and flatness of the scalar power spectrum. One of our goals will be to search for possible solutions to this problem.

It is also not completely clear how reheating works after inflation, due to the peculiar nature of the tachyonic state resulting from annihilation of the brane and antibrane. Some of us have proposed that reheating mediated by the decay of Kaluza-Klein gravitons works naturally when the Standard Model brane is localized in a deeply warped throat, but the details of this proposal, including a precise estimate of the reheating temperature, remain to be worked out.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit102/

Participants:

Burgess, Cliff (McMaster University)
Cline, James (McGill University)
Dasgupta, Keshav (McGill University)
Firouzjahi, Hassan (Cornell University)

Threshold Dynamics, with applications to image processing and computer vision
July 29 - August 5, 2006

Organizers:

Steven Ruuth (Simon Fraser University)

Recently, Grzibovskis and Heintz have found a threshold dynamics that approximates gradient flow for an important curvature dependent functional known as the Willmore energy. This energy consists of the integral of the square of a surface's mean curvature over that surface. Furthermore, it constitutes an essential part certain variational image models for segmentation with depth, disocclusion, and image inpainting. As a first step in bringing threshold dynamics to bear upon higher order models of image processing and computer vision, we recently generalized the work of Grzibovskis and Heintz to the reconstruction of an occluded binary image. In this program we continued our earlier work by considering replacements to the characteristic function representations used in traditional threshold dynamics. We anticipate that by introducing new techniques to threshold dynamics we can broaden the appeal of the methods while simultaneously achieving improved accuracy to high order flows.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit314/

Participants:

Esedoglu, Selim (University of Michigan)
Ruuth, Steven (SFU)
Tsai, Richard (University of Texas, Austin)

The Path Partition Conjecture for Oriented Graphs
August 5 - 12, 2006

Organizers/ Participants:

Jean Dunbar (Converse College, South Carolina)
Marietjie Frick (University of South Africa)
Ortrud Oellermann (University of Winnipeg)
Susan van Aardt (The University of South Africa)

A digraph is called detour saturated if adding an arc between any two non-adjacent vertices results in an increase in the detour order. In order to prove the OPPC it is sufficient to consider detour saturated oriented graphs. Knowledge of the structure of such graphs could therefore facilitate our investigation of the OPPC. Analyzing the structure of detour saturated oriented graphs is also an interesting problem in its own right. We focused our investigations in the structure of detour saturated oriented graphs.

The well-known Gallai-Roy Theorem (which states that the chromatic number of a graph equals the minimum detour order of its orientations) shows that the detour order of oriented graphs is an important parameter. A vertex partition technique used in the proof of this theorem has proved useful for investigating the structure of detour saturated oriented graphs and the OPPC.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit126/

The Topology of Hyperkahler Quotients
August 19 - 26, 2006

Organizers/ Participants:

Megumi Harada (McMaster University)
Greg Landweber (University of Oregon)
Graeme Wilkin (Brown University)

The purpose of this workshop was to address a question concerning the computation of topological invariants of hyperkähler quotients. Our approach is based on the successful and well-developed similar theory for the case of symplectic quotients, so we begin with a brief account of that theory. Symplectic geometry is the mathematical framework of classical mechanics. A symplectic manifold is a manifold equipped with a symplectic form, i.e. a non-degenerate closed differential 2-form, which is the geometric data needed to translate a Hamiltonian function on the system to the dynamics of the system.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit317/

Exact Primal-Dual Regularization of Linear Programs
August 19 - 26, 2006

Organizers/ Participants:

Michael Friedlander (University of British Columbia)
Dominique Orban (Ecole Polytechnique de Montréal)

Linear programming is widely regarded as a vital tool of applied mathematics. Linear programs occur in their own right in such diverse application areas as resource allocation, scheduling, network problems, machine learning and tumor detection, and also as subproblems in the process of solving nonlinear optimization problems. Many practitioners and researchers rely heavily on software for solving large-scale linear programs. Such software must be robust---i.e., can dependably find solutions even for difficult or ill-posed problems---and it must be fast.

The team had already started a research project for improving the reliability and robustness of one of the workhorse class of algorithms for linear programming: that of primal-dual path-following algorithms, and brought together the many pieces of the puzzle. It was hoped that with a concentrated period of work at BIRS, the team would be able to put the final pieces into place and finish the paper.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit322/

Generalized Harish-Chandra Modules of gl(∞)
August 26 - September 4, 2006

Organizers:

Ivan Dimitrov (Queen's University)
Ivan Penkov (International University Bremen)
Gregg Zuckerman (Yale University)

We decided to concentrate on the following two subtopics of the general topic "Generalized Harish-Chandra modules of gl(∞)":

(i) highest weight gl(∞)-modules, existence of maximal submodules in Verma modules induced from general locally finite subalgebras of gl(∞), and the problem of describing the conjugacy classes of maximal locally finite subalgebras of gl(∞).
(ii) a geometric realization of highest weight modules of diagonal direct limit Lie algebras as higher co-homology groups of line bundles on flag ind-spaces.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit072/

Participants:

Dan-Cohen, Elizabeth (UC-Berkeley)
Dimitrov, Ivan (Queen's University)
Penkov, Ivan (International University Bremen)

Second Duals of Measure Algebras
September 9 - 16, 2006

Organizers:

Anthony To-Ming Lau (University of Alberta)

Our main interest is now in the measure algebra M(G), and its second dual (M(G)'', Box). Here G is a locally compact group (the questions are all open for the basic group T), and M(G) is the space of complex-valued, regular Borel measures on G, so that M(G) is a Banach algebra for convolution multiplication. The algebra M(G) contains the group algebra L1(G) as a closed ideal, and coincides with L1(G)= l1(G) if and only if G is discrete; thus the case where G is discrete is covered in our existing second memoir. The algebra (M(G)'', Box) can be identified with an algebra on a complicated compact space which contains the Stone-Cech compactification of the discrete group G as a proper subset. A subset of this space has been studied by Pym et. al. We have a different approach to this space.

There are many basic open questions about the algebra (M(G)'', Box). For example, it is not known in the case of compact G whether M(G) is strongly Arens irregular; this was proved for non-compact G by Neufang. Our objectives are to study the algebra M(G)'', and to write a substantial account of its properties.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit316/

Participants:

Dales, Harold Garth (University of Leeds)
Lau, Anthony To-Ming (University of Alberta)
Strauss, Dona (University of Hull)

Classification of Smooth 4-Manifolds
October 7 - 21, 2006

Organizers/ Participants:

Ronald Fintushel (Michigan State University)
Ronald Stern (University of California, Irvine)

Despite spectacular advances in defining invariants for simply-connected smooth and symplectic 4-dimensional manifolds and the discovery of important qualitative features about these manifolds, we seem to be retreating from any hope to classify simply-connected smooth or symplectic 4-dimensional manifolds. The subject is rich in examples that demonstrate a wide variety of disparate phenomena. Yet it is precisely this richness which, at the time of our work at BIRS, gives us little hope to even conjecture a classification scheme.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06rit320/

Random Sorting Processes
April 22 - May 6, 2006

Organizers:

Omer Angel (University of British Columbia)
Alexander Holroyd (University of British Columbia)
Dan Romik (University of California, Berkeley)
Balint Virag (University of Toronto)

The purpose of the focused research group was to study the Uniform Sorting Network and related random models. These random models bring together ideas from several fields, including probability, interacting particle systems, algebraic combinatorics, Young tableaux and group theory. Our main object of study was the Uniform Sorting Network; that is, a uniformly random reduced word factorization of the permutation (n, . . . , 2, 1) in the symmetric group Sn using the adjacent transpositions (i i + 1) as generators. The study of the combinatorial properties of sorting networks has been a popular area of research among algebraic combinatorialists. The introduction of a probabilistic element in has brought to light very interesting connections with the theory of interacting particle systems and with the geometry of polytopes, and a wealth of striking conjectures. It was with these developments in mind that we decided to organize a meeting to bring together experts from several different related fields and try to attack some of the open problems mentioned.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg501/

Participants:

Angel, Omer (UBC)
Berestycki, Nathanaël (UBC)
Gamburd, Alex (Institute of Advanced Studies)
Hammond, Alan (UBC)
Holroyd, Alexander (UBC)
Kassabov, Martin (Cornell University)
Romik, Dan (University of California, Berkeley)
Virag, Balint (University of Toronto)
Wilson, David (Microsoft Research)

Infinite dimensional Lie algebras and local von Neumann algebras in CFT
May 6 - 20, 2006

Organizers:

Victor Kac (MIT)
Roberto Longo (University of Rome Tor Vergata)

The workshop set up interesting relations between Infinite dimensional Lie algebras and local conformal nets of von Neumann algebras. Each participant has given one of more talks and stimulated discussions on certain topics. Topics included but not limited to:
Representations of Vertex Algebras, Vertex Algebras in Higher Dimensions, Quantum and classical W algebras, Representation theory of local conformal nets and complete rationality.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg103/

Participants:

Bakalov, Bojko (North Carolina State University)
Carpi, Sebastiano (University of Chieti-Pescara)
De Sole, Alberto (Harvard University)
Kac, Victor (MIT)
Kawahigashi, Yasuyuki (University of Tokyo)
Longo, Roberto (University of Rome Tor Vergata)
Weiner, Mihaly (Universita' di Roma Tor Vergata)
Xu, Feng (University of California, Riverside)

Mathematical and Computational Approaches to Linguistic Phylogeny
May 27 - June 3, 2006

Organizers:

Steve Evans (University of California, Berkeley)

Quantitative work needs to be performed in close collaboration with linguists who are not only familiar with the primary data but are also sufficiently mathematically literate that they can participate in the development of models and inferential strategies. Moreover, there need to be several such linguists with different perspectives -- be they on different language families or on “deep time” relationships between different language families. Having a group balanced between four mathematicians/statisticians/computer scientists and four quantitively inclined linguists is the right mix to make serious inroads into the large number of difficult outstanding problems in this field.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg044/

Participants:

Barbanson, Francois (University of Texas at Austin)
Bowern, Claire (Rice University)
Evans, Steve (University of California, Berkeley)
Nicholls, Geoff (Oxford University)
Nichols, Johanna (University of California at Berkeley)
Poser, Bill (University of Pennsylvania / UBC / Yinka Dene Language Institute)
Rezaei, Siamak (University of Northern British Columbia)

Complex Arrangements: Algebra, Geometry, Topology
June 10 - 17, 2006

Organizers:

Hal Schenck (Texas A&M University)
Sergey Yuzvinsky (University of Oregon)

In Fall of 2004, MSRI held a semester-long program on arrangements. The semester was wonderfully stimulating and served both to advance existing projects and foster new collaborations. Interaction among participants, postdocs, and graduate students at MSRI made clear the need for a good, up-to-date central reference for the field. In 1990 Orlik and Terao published a Springer text on ``Arrangements of Hyperplanes”, but the field has advanced dramatically since that time.

The aim of the BIRS workshop was to complete the work on a “state of the art” book on hyperplane arrangements. The workshop was planned as an intense, final wrap up for the book project, as well as a follow-on conference to the MSRI semester and past FRG.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg309/

Participants:

Cohen, Daniel (Louisiana State University)
Denham, Graham (University of Western Ontario)
Falk, Michael (Northern Arizona University)
Schenck, Hal (Texas A&M University)
Suciu, Alexander (Northeastern University)
Terao, Hiroaki (Hokkaido University)
Yuzvinsky, Sergey (University of Oregon)

Off-shell Supersymmetry via Graph Theory and Superspace
July 22 - 29, 2006

Organizers:

Charles Doran (University of Washington)
Gregory Landweber (University of Oregon)

The purpose of this workshop was to study physical supersymmetry (SUSY), i.e., representations of the super Poincaré group and algebra. In particular, we are working towards a classification of *off-shell* supersymmetry, representations of supersymmetry on unconstrained spaces of fields. Supersymmetry is well understood on-shell, in terms of fields dynamically constrained to satisfy equations of motion determined by a Lagrangian. In contrast, *off-shell* supersymmetry is understood only up through spacetime dimension 6, which falls short of the 10 or 11 dimensions required for string theory or M-theory. Indeed, navigating the passage from on-shell to off-shell supersymmetry is called by Gates as “The Fundamental Supersymmetry Challenge”.

Traditionally, off-shell fields have been constructed by considering superfields on superspace, a supersymmetric extension of spacetime. Our approach is different, instead studying the reductions of supersymmetric theories to one time dimension, in terms of mechanics. Our primary tools are Adinkras, graph-theoretic diagrams which encapsulate the combinatorial data required to classify the one-dimensional supersymmetric theories. In this workshop, we use Adinkras to classify known theories and generate new ones, in an attempt to understand the deeper meanings of Adinkras and test their limits.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg313/

Participants:

Doran, Charles (University of Washington)
Faux, Michael (State University of New York - College at Oneonta)
Hubsch, Tristan (Howard University)
Iga, Kevin (Pepperdine University)
Landweber, Gregory (University of Oregon)

Statistical Models for the Study of Science Teacher OTL in Canada
August 12 - 19, 2006

Organizers:

Richard Houang (Michigan State University)
HsingChi von Bergmann (University of Calgary)

One of the objectives of the Study of Teachers’ Science Opportunity to Learn in Canada, funded by SSHRC, is to develop a Survey of Teacher Science Opportunities (STSO) to understand how opportunities to acquire science knowledge, pedagogical knowledge and pedagogical content knowledge impact middle school science education. To understand the inter-relationship among content knowledge, pedagogical knowledge and pedagogical content knowledge, it is critical to network with statisticians who have been the leading experts in applying statistics in large-scale international comparative education study. The focused group was charged to devise a statistical model to analyze data collected from Canadian teacher education Institutions.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg310/

Participants:

Childs, Ruth (OISE, University of Toronto)
Fry, David J. I. (University of Calgary)
Luft, Julie A. (Arizona State University)
Pascuzzo, Tony (University of Calgary)
Vazquez-Abad, Jesus (Université de Montreal)
von Bergmann, HsingChi (University of Calgary)

Inverse Protein Folding
September 5 - 9, 2006

Organizers:

Ken Dill (Universtiy of California, San Francisco)
Arvind Gupta (Simon Fraser University)
Ladislav Stacho (Simon Fraser University)

This meeting brought together mathematical scientists with biophysicists, computational pharmaceutical chemists, and others interested in novel techniques for drug design. By getting the right expertise together, the workshop allowed us to develop a short- and long-term plan for research in the area by helping us to define key problems and pooling expertise. Specific goals:

1. What is the right model for inverse protein folding in 3D? What chemical interactions must be considered. 2. Develop a better model for specifying target protein structure. The mathematical models likely do not correspond well to the ones used by clinicians and this hurdle must be overcome. 3. Understand what are the appropriate underlying assumptions in real inverse protein folding. Are lattice structures realistic? 4. Develop milestones for progress and make plans for a larger meeting in the future (possibly at BIRS) .

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg321/

Participants:

Bremner, David (University of New Brunswick)
Condon, Anne (UBC)
Dill, Ken (Universtiy of California, San Francisco)
Elber, Ron (Cornell University)
Gupta, Arvind (SFU)
Manuch, Jan (SFU)
Stacho, Ladislav (SFU)

Quantum algorithms for algebraic problems
September 16 - 23, 2006

Organizers:

Ashwin Nayak (University of Waterloo/ Perimeter Institute)
John Watrous (University of Calgary)
Leonard Schulman (Caltech)

Quantum computers are computational devices that are based on principles of quantum mechanics. Phenomenasuch as superposition—the ability to exist in several states simultaneously, and interference—the ability of different computation paths to combine constructively as well as destructively, allow quantum computers a much broader range of operations than possible with current computers, which are based on the laws of classical physics. The potential of quantum devices to outperform current computers was rigorously demonstrated by Bernstein and Vazirani in 1993. Since then, efficient quantum algorithms have been discovered for a number of important problems, including integer factorization and the discrete logarithms. No efficient (polynomial-time) classical algorithms are known for these problems. In fact, cryptosystems such as RSA, whose security rests upon the computational intractability of factorization and discrete logs, are in widespread use.

Quantum computers seem to be especially effective in solving problems with a group-theoretic flavour. The aim of the meeting was to develop new techniques that will allow us to tackle some outstanding questions concerning algebraic problems such as Graph Isomorphism, and Closest Lattice Vector. These problems are of complexity in between P and NP, and are considered candidates for efficient quantum algorithms.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg323/

Participants:

Childs, Andrew (California Institute of Technology)
de Beaudrap, Niel (University of Waterloo)
Hallgren, Sean (NEC Laboratories America, Inc.)
Nayak, Ashwin (University of Waterloo/ Perimeter Institute)
Schulman, Leonard (Caltech)
Vazirani, Umesh (UC-Berkeley)
Watrous, John (University of Calgary)

Models and Algorithms for the Web Graph (WAW2006) -- MITACS 2-day Workshop November 29 - December 2, 2006

Organizers:

Bill Aiello (University of British Columbia)
Andrei Broder (Yahoo! Inc.)
Jeannette Janssen (Dalhousie University)
Evangelos Milios (Dalhousie University)

The World Wide Web has become part of our everyday life and information retrieval and data mining on the Web are now of enormous practical interest. The algorithms supporting these activities combine the view of the Web as a text repository and as a graph, induced in various ways by links among pages, links among hosts, or other similar networks.

The aim of the 2006 Workshop on Algorithms and Models for the Web-Graph (WAW2006) was to further the understanding of these Web-induced graphs, and stimulate the development of high-performance algorithms and applications that use the graph structure of the Web. The workshop was meant both to foster an exchange of ideas among the diverse set of researchers already involved in this topic, and to act as an introduction for the larger community to the state of the art in this area.

This is the fourth edition of a very successful workshop on this topic. WAW 2002 and 2004 were held in conjunction with the Annual IEEE Symposium on Foundations of Computer Science (FOCS). WAW2003 was held in conjunction with the Twelfth International World Wide Web Conference, WWW 2003.

For details, please refer to the workshop webpage
http://www.birs.ca/workshops/2006/06frg308/

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Bonato, Anthony (Wilfrid Laurier University)
Broder, Andrei (Yahoo! Inc.)
Chakrabarti, Soumen (IIT Bombay)
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Das, Tapajyoti (IT Interactive Services Inc.)
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Gao, Yong (UBC Okanagan)
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Lang, Kevin (Yahoo Inc.)
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Litvak, Nelly (Universiteit Twente)
Manasse, Mark (Microsoft Research)
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Posenato, Roberto (State University of Verona)
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Willinger, Walter (AT&T Labs-Research)
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Deer and magpie by Brent Kearney

The **Banff International Research Station** for Mathematical Innovation and Discovery (BIRS) is a collaborative Canada-US-Mexico venture that provides an environment for creative interaction as well as the exchange of ideas, knowledge, and methods within the Mathematical Sciences, with related disciplines and with industry. The research station is located at The Banff Centre in Alberta and is supported by Canada's Natural Science and Engineering Research Council (NSERC), the US National Science Foundation (NSF), Alberta's Advanced Education and Technology, and Mexico's Consejo Nacional de Ciencia y Tecnología (CONACYT).

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BIRS is also supported by:

The Pacific Institute for the Mathematical Sciences (PIMS)
The Mathematics of Information Technology and Complex Systems Network (MITACS)
The Mathematical Science Research Institute, Berkeley (MSRI)
The Instituto de Matemáticas - Universidad Nacional Autónoma de México (IM-UNAM)