Banff International Research Station
for Mathematical Innovation and Discovery

2012 Scientific Report

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5-Day Workshops 2012

Jan 08	Jan 13	Quantum Technology: Computational Models for Quantum Device Design
Jan 15	Jan 20	Interactive Information Theory
Jan 22	Jan 27	Emergent Behaviour in Multi-particle Systems with Non-local Interactions
Jan 29	Feb 03	Neostability Theory
Feb 05	Feb 10	Models of Sparse Graphs and Network Algorithms
Feb 05	Feb 10	Probabilistic versus Deterministic Techniques for Shared Memory Computation
Feb 12	Feb 17	Ordered Groups and Topology
Feb 12	Feb 17	Algebraic K-Theory and Equivariant Homotopy Theory
Feb 19	Feb 24	Outstanding Challenges in Combinatorics on Words
Feb 26	Mar 02	Operator Structures in Quantum Information Theory
Mar 04	Mar 09	Banach Space Theory
Mar 11	Mar 16	Advances in Hyperkähler and Holomorphic Symplectic Geometry
Mar 18	Mar 23	Challenges and Advances in High Dimensional and High Complexity Monte Carlo Computation and Theory
Mar 25	Mar 30	Algebraic Stacks: Progress and Prospects
Apr 01	Apr 06	Stochastic Analysis and Stochastic Partial Differential Equations
Apr 08	Apr 13	Open Dynamical Systems: Ergodic Theory, Probabilistic Methods and Applications
Apr 15	Apr 20	Geometric Structures on Manifolds
Apr 22	Apr 27	Composite Likelihood Methods
Apr 29	May 04	Manifolds with Special Holonomy and their Calibrated Submanifolds and Connections
May 06	May 11	Linking Representation Theory, Singularity Theory and Non-Commutative Algebraic Geometry
May 13	May 18	Connections Between Regularized and Large-Eddy Simulation Methods for Turbulence
May 20	May 25	Optimal Transportation and Differential Geometry
May 27	Jun 01	Frontiers in the Detection and Attribution of Climate Change
Jun 03	Jun 08	Arithmetic Geometry of Orthogonal and Unitary Shimura Varieties
Jun 17	Jun 22	Descriptive Set Theory and Functional Analysis
Jun 24	Jun 29	Eigenvalues/Singular Values and Fast PDE Algorithms: Acceleration, Conditioning, and Stability
Jul 01	Jul 06	Torsion in the Homology of Arithmetic Groups: Geometry, Arithmetic, and Computation
Jul 08	Jul 13	Interactions Between Continuous and Discrete Holomorphic Dynamical Systems
Jul 15	Jul 20	Rigidity Theory: Progress, Applications and Key Open Problems
Jul 22	Jul 27	Tissue Growth and Morphogenesis: from Genetics to Mechanics and Back
Jul 29	Aug 03	Conformal and CR geometry
Aug 05	Aug 10	Recent Trends in Geometric and Nonlinear Analysis
Aug 12	Aug 17	Syzygies in Algebraic Geometry, with an Exploration of a Connection with String Theory
Aug 19	Aug 24	New Trends and Directions in Combinatorics
Aug 26	Aug 31	The Geometry of Scattering Amplitudes
Sep 02	Sep 07	Groups and Geometries
Sep 09	Sep 14	Evolution Equations of Physics, Fluids, and Geometry: Asymptotics and Singularities
Sep 16	Sep 21	Model Reduction in Continuum Thermodynamics: Modeling, Analysis and Computation
Sep 23	Sep 28	Integrable Systems, Growth Processes and KPZ Universality
Sep 30	Oct 05	Lie Algebras, Torsors and Cohomological Invariants
Oct 07	Oct 12	Graph Searching
Oct 14	Oct 19	Topological Data Analysis and Machine Learning Theory
Oct 21	Oct 26	Recent Advances in Transversal and Helly-type Theorems in Geometry, Combinatorics and Topology
Oct 28	Nov 02	New Trends in Noncommutative Algebra and Algebraic Geometry
Nov 04	Nov 09	Spectral Analysis, Stability and Bifurcation in Modern Nonlinear Physical Systems
Nov 11	Nov 16	Nonequilibrium Statistical Mechanics: Mathematical Understanding and Numerical Simulation
Nov 18	Nov 23	First Nations Math Education
Nov 25	Nov 30	Cohomological Methods in Geometric Group Theory
Dec 02	Dec 07	String Theory and Generalized Geometries
Dec 09	Dec 14	Thin Liquid Films and Fluid Interfaces: Models, Experiments and Applications

2-Day Workshops 2012

Mar 30	Apr 01	North West Functional Analysis Seminar
Apr 27	Apr 29	Ted Lewis Workshop on SNAP Math Fairs in 2012
May 25	May 27	Workshop on Robust Optimization
Jun 22	Jun 24	Differential Schemes and Differential Cohomology
Jul 13	Jul 15	Women's Workshop on Communications and Signal Processing
Jul 20	Jul 22	Inductive Constructions in Rigidity Theory
Jul 27	Jul 29	Theoretical and Applied Aspects of Nonnnegative Matrices
Aug 03	Aug 05	Math Kangaroo Contest
Oct 26	Oct 28	G4G, Gathering for Gardner, Puzzles in the Classroom
Nov 23	Nov 25	Early Years Spatial Reasoning: Learning and Teaching

Summer Schools

Jun 10	Jun 17	Contemporary Methods for Solving Diophantine Equations
Jun 24	Jul 08	2012 Summer IMO Training Camp

Research In Teams

Apr 29	May 06	Dialgebras, Leibniz Algebras, and Quasi-Jordan Algebras
May 13	May 20	Isomorphisms and Isometries of Spaces of Continuous Functions
May 20	May 27	Toric Boij-Söderberg Theory
May 27	Jun 03	A New Implementation of Fletcher's Exact Merit Function for Nonlinear Optimization
Jun 10	Jun 17	Strong Asymptotics for Cauchy Biorthogonal Polynomials
Jul 22	Jul 29	Renormalization Group Methods for Polymer and Last Passage Percolation Models
Aug 05	Aug 12	Models for Minimal Cantor Z^2 Systems
Aug 12	Aug 19	Moduli Spaces in Conformal Field Theory and Teichmuller Theory
Sep 09	Sep 16	Random Gradient Models with Degenerate Potential
Sep 23	Sep 30	Positive Semidefinite Zero Forcing and Applications
Nov 04	Nov 11	Sarason Conjecture and the Composition of Paraproducts

Focused Research Groups

Apr 22	Apr 29	Novel Approaches to the Finite Simple Groups
May 06	May 13	Geometrization of Smooth Characters
Jul 29	Aug 05	The d-bar Method: Inverse Scattering, Nonlinear Waves, and Random Matrices
Aug 19	Aug 26	The p-adic Langlands Program for Non-split Groups
Aug 26	Sep 02	A t-Pieri rule for Hall-Littlewood P-functions and QS(t)-functions
Sep 02	Sep 09	The Advent of Quark-Novae: Modeling a New Paradigm in Nuclear Astrophysics
Sep 16	Sep 23	Generalized Gauss Maps and Farey Statistics
Oct 07	Oct 14	Supercharacters and Hopf Monoids
Oct 21	Oct 28	Animal Movement and Memory
Dec 02	Dec 12	Spectral and Asymptotic Stability in Nonlinear Dirac Equations

Banff International Research Station

2012

5-Day Workshops

Quantum Technology: Computational Models for Quantum Device Design
January 8-13, 2012

Organizers:

Lloyd Hollenberg (University of Melbourne)
Frank Langbein (Cardiff University)
Sophie (Sonia) Schirmer (Swansea University)

The workshop explored models and techniques for designing and controlling quantum devices and establish links between physical (quantum) device modelling, experimental system identification, model verification and quantum control. Having reliable mathematical and computational models and methods is crucial for quantum engineers to design realistic quantum devices. This includes tools that allow not only efficient simulation of complicated quantum devices such as semi-conductor nanostructures, superconducting devices or atom chips, but also device optimization and dynamic control.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5061

Participants:

Aytac, Jon (University of California, Berkeley)
Balas, Mark (University of Wyoming)
Bandrauk, André D (Université de Sherbrooke)
Burgarth, Daniel (Imperial College)
Cai, Jianming (Ulm University)
Calarco, Tommaso (University of Ulm)
Fonseca, Jim (Purdue University)
Gao, Suzey (Sandia National Laboratories)
Glaser, Steffen (TU Munich)
Gualdi, Giulia (University of Kassel)
Hollenberg, Lloyd (University of Melbourne)
Hoyer, Stephan (University of California, Berkeley)
James, Matthew (Australian National University)
Jonckheere, Edmond (USC)
Kuprov, Ilya (University of Oxford)
Langbein, Frank (Cardiff University)
Muller, Richard (Sandia National Laboratories)
Müller, Clemens (Université de Sherbrooke)
Nielsen, Erik (Sandia National Laboratories)
Oi, Daniel (Strathclyde University)
Petersen, Ian (UNSW)
Plenio, Martin (University of Ulm)
Quinn, Jonathan (Cardiff University)
Rahman, Rajib (Sandia National Laboratories)
Rees, Paul (Swansea University)
Sanders, Yuval (University of Waterloo)
Sanders, Barry (University of Calgary)
Schirmer, Sophie (Sonia) (Swansea University)
Schulte-Herbruggen, Thomas (Technical University Munich)
Shaterzadeh Yazdi, Zahra (University of Calgary)
Wang, Dongsheng (University of Calgary)
Zhang, Jun (Shanghai Jiao Tong University)

Interactive Information Theory
January 15-20, 2012

Organizers:

Ian Blake (University of British Columbia)
Natasha Devroye (University of Illinois at Chicago)
Ashish Khisti (University of Toronto)

This workshop facilitated the exchange of mathematical tools and ideas in order to make significant headway on open problems in two-way information theory and brought together experts from three areas of information theory: source coding, channel coding, and directed information metrics and applications, who all have a particular focus on interactive communication models.

This platform helped to acheive the following goals:
1. Disseminated recent research results through a series of 1/2 hour talks, which exposed experts in one area to recent results in another, while promoting collaboration across the different information theory areas.
2. Introduced more classical two-way / interactive results in each area through 1 hour tutorial talks, which educated and re-visited results from one area in a comprehensive manner, outlined key sticking points, and shedded new light onto the challenges.
3. Posed and attacked open problems - each attendee presented at least one focused and formulated open problem along with past methods of attack to the group.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5119

Participants:

Boche, Holger (Technical University of Munich)
Braverman, Mark (Princeton University)
Chamberland, Jean-Francois (Texas A & M)
Devroye, Natasha (University of Illinois at Chicago)
Draper, Stark (University of Wisconsin-Madison)
Eckford, Andrew (York University)
Ekrem, Ersen (University of Maryland)
Grover, Pulkit (Stanford University)
Han, Te Sun (National Institute of Information and Communications Technology)
Hassibi, Babak (California Institute of Technology)
Ishwar, Prakash (Boston University)
Khisti, Ashish (University of Toronto)
Kim, Young-Han (UC, San Diego)
Ma, Nan (University of California at Berkeley)
Mahajan, Aditya (McGill University)
Malloy, Matt (University of Wisconsin - Madison)
Meng, Jin (University of Waterloo)
Narayan, Prakash (University of Maryland)
Nazer, Bobak (Boston University)
Nowak, Robert (University of Wisconsin-Madison)
Oechtering, Tobias (KTH Royal Institute of Technology)
Popovski, Petar (Aalborg University)
Rao, Anup (University of Washington)
Smida, Besma (Purdue University)
Steinberg, Yossef (Technion)
Tuninetti, Daniela (University of Illinois at Chicago)
Tutuncuoglu, Kaya (Penn State University)
Tyagi, Himanshu (University of Maryland)
Ulukus, Sennur (University of Maryland)
Venkataramanan, Ramji (Yale University)
Willems, Frans (Eindhoven University of Technology)
Yener, Aylin (The Pennsylvania State University)

Emergent Behaviour in Multi-particle Systems with Non-Local Interactions
January 22-27, 2012

Organizers:

Andrea Bertozzi (UCLA)
Jose Antonio Carrillo (Imperial College, London)
Razvan Fetecau (Simon Fraser University)
Theodore Kolokolnikov (Dalhousie University)
Mark Lewis (University of Alberta)

This workshop disseminated recent advances in theory and applications of multi-particle models in mathematics, biology, engineering and other fields and brought together leading experts representing the diverse groups that are working on multi-particle models, both from the point of view of modelling and mathematical techniques. The use of nonlocal models is becoming widespread in both modelling and theory. Mathematicians and experimentalists, particularly in biology and robotics, attempted to identify the proper mechanisms for swarm formations among the many possible scenarios and identified the benefitsthat the swarming behaviour confers on individual members or the species as a whole.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5041

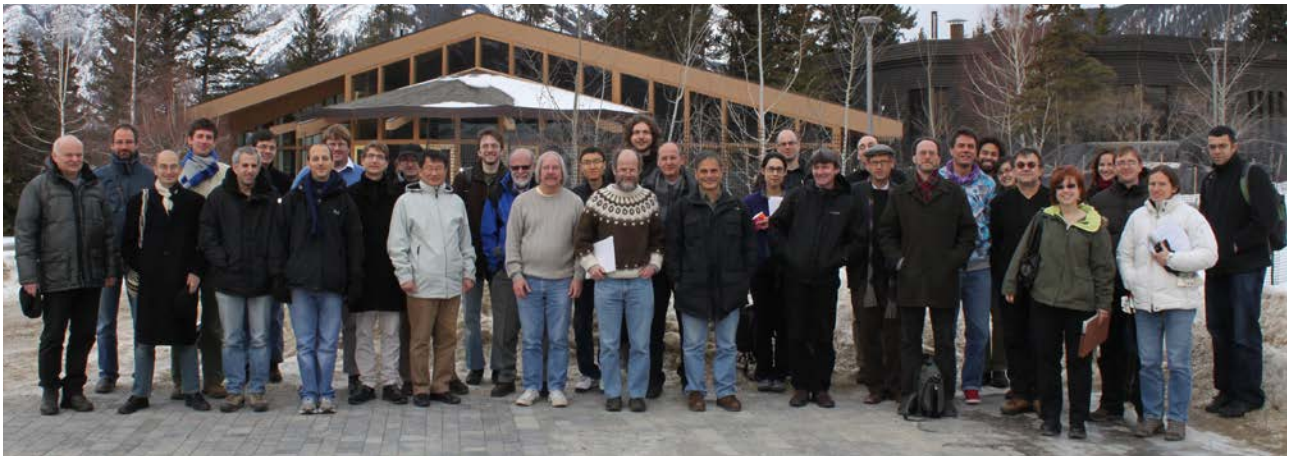
Participants:

Agueh, Martial (University of Victoria)
Balague, Daniel (Universitat Autònoma de Barcelona)
Barbaro, Alethea (UCLA)
Bedrossian, Jacob (UCLA)
Bernoff, Andrew (Harvey Mudd College)
Bertozzi, Andrea (UCLA)
Birnir, Bjorn (UCSB)
Carrillo, Jose Antonio (Imperial College, London)
Chen, Yuxin (Dalhousie)
D'Orsogna, Maria Rita (Calfiornia State University Northridge)
de Vries, Gerda (University of Alberta)
Eftimie, Raluca (McMaster University)
Einarsson, Baldvin (Center for Complex and Nonlinear Science)
Erban, Radek (University of Oxford)
Escudero, Carlos (Universidad Autonoma de Madrid)
Fellner, Klemens (University of Graz)
Fetecau, Razvan (Simon Fraser University)
Forgoston, Eric (Montclair State University)
Frouvelle, Amic (Institut de Mathématiques de Toulouse)
Gazi, Veysel (Istanbul Kemerburgaz University)
Ha, Seung Yeal (Seoul National University)
Haskovec, J. (Austrian Academy of Sciences)
Huang, Yanghong (Simon Fraser University)
Kolokolnikov, Theodore (Dalhousie University)
Laurent, Thomas (UCR)
Lega, Joceline (University of Arizona)
Levy, Doron (University of Maryland, College Park)
Lewis, Mark (University of Alberta)
Lindsay, Alan (University of Arizona)
Martin, Stephan (Technical University of Kaiserslautern)
Motsch, S. (University of Maryland)
Panferov, Vladislav (California State University, Northridge)
Pavlovski, Mark (Dalhousie)
Putkaradze, Vakhtang (Colorado State University)
Raoul, Gael (University of Cambridge)
Rodriguez, Nancy (Stanford)
Rosado, Jesus (UCLA)
von Brecht, J. (UCLA)
Ward, Michael (University of British Columbia)
Wennberg, Bernt (Chalmers University of Technology)
Williams, JF (Simon Fraser University)
Yao, Yao (University of Wisconsin Madison)

Neostability Theory
January 29-February 3, 2012

Organizers:

Bradd Hart (McMaster University)
Ehud Hrushovski (Hebrew University at Jerusalem)
Alf Onshuus (Universidad de los Andes, Edificio H)
Anand Pillay (University of Leeds)
Thomas Scanlon (UC, Berkeley)
Frank Wagner (Université Claude Bernard Lyon 1)



Stability theory, in the sense of mathematical logic, consists of a collection of technical methods first developed to address the logical problem of classifying abstract models of mathematical theories. Stability theory has proven to be applicable to other mathematical problems ranging from understanding rational solutions of algebraic equations to setting definite b-ounds in learning processes in artificial intelligence. It has recently been shown that the techniques and methods used for the classification described above can be used in much more general settings with applications to algebraic geometry and additive combinatorics. Researchers at this meeting have studied these developments to extend the scope of stability theory to a wider range of mathematical theories. They have analyzed what is known and what needs to be done in the foundational work of four related fields: dependent theories, the topology of generically stable types in dependent theories, the role of non forking outside stable theories and the applications to additive combinatorics, and the common ideas behind dp-miniality, dp-rank, burden and VC-density.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5045

Participants:

Adler, Hans (Vienna University)
Aschenbrenner, Matthias (UCLA)
Baldwin, John (University of Illinois at Chicago)
Baudisch, Andreas (Humboldt-Universität zu Berlin)
Ben Yaacov, Itaï (Université Lyon I)
Berenstein, Alexander (Universidad de Los Andes)
Bouscaren, Elisabeth (CNRS - Universite Paris-Sud 11 Orsay)
Boxall, Gareth (Stellenbosch University)
Casanovas, Enrique (Universitat de Barcelona)
Chatzidakis, Zoé (CNRS - Université Paris 7)
Chernikov, Artem (Université Claude Bernard - Lyon 1)
Dolich, Alfred (East Stroudsburg University)
Ealy, Clifton (Western Illinois University)
Flenner, Joseph (University of Notre Dame)
Gismatullin, Jakub (University of Leeds)
Goodrick, John (Universidad de los Andes)
Guingona, Vincent (University of Maryland)
Harrison-Shermoen, Gwyneth (UC, Berkeley)
Haskell, Deirdre (McMaster University)
Hasson, Assaf (Ben Gurion University of the Negev)
Hill, Cameron (University of Notre Dame)
Hils, Martin (Université Paris Diderot Paris 7)
Kaplan, Itay (Universität Konstanz)
Kim, Byunghan (Yonsei University)
Kim, Hyeung-joon (Yonsei University)
Krupinski, Krzysztof (Uniwersytet Wroclawski)
Laskowski, Chris (University of Maryland)
Lippel, David (Haverford College)
MacPherson, Dugald (University of Leeds)
Malliaris, Maryanthe (University of Chicago)
Milliet, Cédric (Galatasaray Üniversitesi)
Newelski, Ludomir (Uniwersytet Wroclawski)
Peterzil, Kobi (University of Haifa)
Scow, Lynn (University of Illinois at Chicago)
Simon, Pierre (Ecole Normale Supérieure (Paris))
Starchenko, Sergei (University of Notre Dame)
Steinhorn, Charles (Vassar College)
Tanovic, Predrag (Matematicki Institut SANU)
VanDieren, Monica (Robert Morris University)
Wagner, Frank (Université Claude Bernard Lyon 1)
Ziegler, Martin (Mathematisches Institut Freiburg)

Models of Sparse Graphs and Network Algorithms
February 5-10, 2012

Organizers:

Nicolas Broutin (Inria Paris-Rocquencourt)
Luc Devroye (McGill University)
Gabor Lugosi (Pompeu Fabra University)

There is no doubt now that the current trend that every electronic device should be connected in one way or another (usually many) implies a greater need for efficient networks. These networks should be connected, exhibit small-world behaviour and their topology should be robust to local modifications like device movement; all this should be achieved using minimal (devices might not be powerful) and distributed processes. The topic discussed in this workshop lies at the intersection of computer science, computational geometry, operations research, and theoretical probability; it also raised both exciting mathematical problems and hitted on very practical aspects of today's technological challenges. This meeting gathered experts from the different communities involved, gave them the opportunity to expose their points of view, and fostered fruitful exchanges. Moreover, this forum facilitated researchers to make a state-of-the-art on the subject quickly available to a broader audience, in particular graduate students.

This workshop involved scientific presentations, organized discussions and group work sessions which focussed on the following issues: (1) the models of sparse geometric networks have so far mainly been studied using very little knowledge of the mathematical percolation corpus; (2) the spanning ratio of a network is the maximal ratio over all pairs of points of the graph distance over the shortest (geometric, Euclidean) distance; (3) the universality of the behaviour of graph models; and (4) a first step towards more general results about broadcasting algorithms consists in characterizing the time for rumour spreading in terms of an important parameter of the connectivity of the graph that would be computed for specific examples.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5004

Participants:

Addario-Berry, Louigi (McGill University)
Aldous, David (University of California Berkeley)
Bhamidi, Shankar (University of North Carolina)
Bordenave, Charles (CNRS & Université de Toulouse)
Bose, Prosenjit (Carleton University)
Boucheron, Stéphane (Université Paris-Diderot (Paris 7))
Broutin, Nicolas (Inria Paris-Rocquencourt)
Devroye, Luc (McGill University)
Dujmovic, Vida (Carleton University)
Fraiman, Nicolas (McGill University)
Khalil, Omar (McGill University)
Langerman, Stefan (Université Libre de Bruxelles)
Lelarge, Marc (INRIA)
Lugosi, Gabor (Pompeu Fabra University)
Morin, Pat (Carleton University)
Müller, Tobias (Utrecht University)
Penrose, Mathew (University of Bath)
Salez, Justin (UC Berkeley)
Toth, Csaba (University of Calgary)
Yukich, Joseph (Lehigh University)

Probabilistic versus Deterministic Techniques for Shared Memory Computation
February 5-10, 2012

Organizers:

Hagit Attiya (Technion)
Maurice Herlihy (Brown University)
Philipp Woelfel (University of Calgary)

This workshop allowed international experts, promising junior researchers, and some exceptional graduate students and postdocs to achieve the following goals:
(1) Identified and promoted techniques to prove upper and lower bounds for randomized computation; devised design paradigms for randomized distributed algorithms; and attempted to understand the applicability and limits of Yao's Min-Max principle. In sequential computing, several standard techniques, such as tail bounds or Yao's Min-Max principle are used frequently for algorithm analysis. This workshop explored whether or not there are techniques that are particularly applicable to distributed computing;
(2) Gained insights into the power and limitations of randomized algorithms compared to deterministic algorithms. This meeting explored the question, "For which types of problems or models can we hope to be able to gain speedups using randomization;"
(3) Explored how changes in assumptions effect the complexivty of probabilistic solutions to problems; and
(4) Tackled the analysis of the randomized complexity of core shared-memory problems: (a) For standard problems such as mutual exclusion or consensus, randomized algorithms exist, but often the exact complexity is still unknown; (b) For other problems, no randomized algorithms have been developed, yet. Of particular interest is the efficient implementation of strong primitives from weaker ones by using randomization.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5122

Participants:

Alistarh, Dan (École Polytechnique Fédérale de Lausanne)
Aspnes, James (Yale University)
Attiya, Hagit (The Technion)
Bender, Michael (Stony Brook University)
Censor-Hillel, Keren (MIT)
Ellen, Faith (University of Toronto)
Giakkoupis, George (University of Calgary)
Gilbert, Seth (National University of Singapore)
Golab, Wojciech (HP Labs)
Hendler, Danny (Ben-Gurion University)
Herlihy, Maurice (Brown University)
Higham, Lisa (University of Calgary)
King, Valerie (University of Victoria)
Michael, Maged (IBM Thomas J Watson Research Center)
Oshman, Rotem (MIT)
Ruppert, Eric (York University)
Saia, Jared (University of New Mexico)
Welch, Jennifer (Texas A & M)
Woelfel, Philipp (University of Calgary)

Ordered Groups and Topology
February 12-17, 2012

Organizers:

Steven Boyer (Université du Quebec à Montréal)
Patrick Dehornoy (University of Caen)
Peter Linnell (Virginia Tech)
Akbar Rhemtulla (University of Alberta)
Dale Rolfsen (University of British Columbia)
Adam Sikora (SUNY - Buffalo)

This workshop explored new connections between algebra and topology (a modern field inspired by geometry). Applications of this interaction include such things as the classification of knots and the possible shapes of our universe, as well as a deeper understanding of algebra and ordered systems.

Returning to applications of orderable groups to topology, there is very recent evidence of connections between the structure of Heegaard-Floer and similar homology theories and the orderability (or non-orderability) of fundamental groups of 3-manifolds constructed by surgery on knots and links. Ozsvath and Szabo define L-spaces to be 3-manifolds with trivial rational homology and HF homology as simple as possible. It was shown by Boyer and Watson that the 3-dimensional Seifert fibred spaces which are L-spaces are exactly those whose fundamental group is not left-orderable. This workshop has enhanced the understanding of the interplay of ordered group theory and the topology of manifolds (and structures on them, such as foliations, fibrations, contact structures), which is a new and promising area of research.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5009

Participants:

Boyer, Steven (Université du Quebec à Montréal)
Clay, Adam (Univ. Quebec at Montreal)
Dehornoy, Patrick (University of Caen)
Dunfield, Nathan (UIUC)
Gordon, Cameron (University of Texas at Austin)
Ito, Tetsuya (Univ. Tokyo)
Koberda, Thomas (Yale University)
Lidman, Tye (UCLA)
Linnell, Peter (Virginia Tech)
Menasco, William (University at Buffalo)
Morris, Dave (University of Lethbridge)
Navas, Andres (Universidad de Santiago de Chile)
Paris, Luis (Université de Bourgogne)
Przytycki, Jozef (George Washington University)
Rhemtulla, Akbar (University of Alberta)
Rivas, Cristobal (ENS-Lyon)
Roberts, Rachel (Washington University)
Rolfsen, Dale (University of British Columbia)
Sikora, Adam (SUNY - Buffalo)
Stein, Melanie (Trinity College)
Watson, Liam (UCLA)

Algebraic K-Theory and Equivariant Homotopy Theory
February 12-17, 2012

Organizers:

Vigleik Angeltveit (Australian National University)
Andrew Blumberg (University of Texas at Austin)
Teena Gerhardt (Michigan State University)
Michael Hill (University of Virginia)
Tyler Lawson (University of Minnesota)

This workshop brought together homotopy theorists and motivic homotopy theorists to attempt to unify the approaches and strengthen the connections. Tools like the slice spectral sequence in both the equivariant and motivic contexts already bridge the gap, and it would be helpful for each side to see the approaches and techniques of the other. Additionally, this workshop made the relatively impenetrable fields of equivariant homotopy theory and algebraic K-theory more approachable to young researchers. Many of the foundational results of this field have been buried in the literature or are simply known only to experts, and there is a paucity of elementary treatments. Bringing together researchers of all levels at this meeting have helped to clarify many mysterious points in the literature. The following highlights have been discussed at the workshop:
(1) Why does the standard smash product in structured spectra fail to produce a model for THH with the right properties? Is there a way to fix this without relying on the Bökstedt model?
(2) How does the interplay between finite subgroups of S1 and S1 affect our choice of model and universe? Can we produce a conceptually cleaner result by ignoring the S1 part and focusing on the pieces seen by finite subgroups?

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5116

Participants:

Angeltveit, Vigleik (Australian National University)
Blumberg, Andrew (University of Texas at Austin)
Bohmann, Anna Marie (Northwestern University)
Carlsson, Gunnar (Stanford University)
Douglas, Christopher (Oxford University)
Dundas, Bjorn (University of Bergen)
Gerhardt, Teena (Michigan State University)
Greenlees, John (University of Sheffield)
Guillou, Bertrand (UIUC)
Hesselholt, Lars (Nagoya University)
Hill, Michael (University of Virginia)
Lawson, Tyler (University of Minnesota)
Lind, John (Johns Hopkins University)
Mandell, Michael A. (Indiana University)
May, Peter (University of Chicago)
Osorno, Angelica (University of Chicago)
Ramras, Daniel (New Mexico State University)
Ravenel, Douglas (University of Rochester)
Schwede, Stefan (Universitaet Bonn)
Shipley, Brooke (University of Illinois, Chicago)

Outstanding Challenges in Combinatorics on Words
February 19-24, 2012

Organizers:

James Currie (University of Winnipeg)

Jeffrey Shallit (University of Waterloo)

Abstract sequences of symbols arise in studying such disparate topics as DNA sequencing, the compression of computer data, the digits of Pi and algebraic equations. Combinatorics on words is the relatively new area of discrete mathematics that studies the avoidable or unavoidable regularities in such sequences. Problems of combinatorics on words, like those of number theory, can be deceptively simple to state, but are notoriously difficult to unravel. Recent breakthroughs, however, like the resolution of the decades-old Dejean's Conjecture, have led to a new interest and momentum in this area. This workshop have brought together world experts in the various flavours of combinatorics on words to identify, attack, and even solve some of the outstanding problems of this field.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5068

Participants:

Adamczewski, Boris (Institu Camille Jordan & CNRS)
Arnoux, Pierre (Université d'Aix-Marseille 2)
Badkobeh, Golnaz (King's College London)
Bedaride, Nicolas (Aix-Marseille University)
Bell, Jason (Simon Fraser University)
Berthe, Valerie (LIAFA)
Blanchet-Sadri, Francine (University of North Carolina Greensboro)
Brlek, Srecko (UQAM)
Bucci, Michelangelo (University of Turku)
Carpi, Arturo (Universita Degli Studi Di Perugia)
Cassaigne, Julien (IML-CNRS, Marseille)
Charlier, Emilie (Université Libre de Bruxelles)
Crochemore, Maxime (King's College London)
Currie, James (University of Winnipeg)
Diekert, Volker (University of Stuttgart)
Domaratzki, Michael (University of Manitoba)
Ferenczi, Sebastien (Institut de Mathematiques de Luminy)
Frid, Anna (SBRAS)
Glen, Amy (Murdoch University)
Holub, Stepan (Charles University)
Karhumäki, Juhani (University of Turku)
Kopecki, Steffen (University of Western Ontario)
Labbé, Sébastien (UQAM))
Leroy, Julien (Université de Liège)
Matiyasevich, Yury (Steklov Institute of Mathematics)
Mercas, Robert (Informatik at Otto-von-Guericke Universitat at Magdeburg)
Nowotka, Dirk (Kiel University)
Ochem, Pascal (Paris-Sud - Equipe Algorithmique et Complexite)
Puzynina, Svetlana (University of Turku)
Rampersad, Narad (University of Liege)
Rao, Michael (LaBRI - CNRS - Université Bordeaux 1)
Restivo, Antonio (University of Palermo)
Rowland, Eric (UQAM)
Saarela, Aleksi (University of Turku)
Saliola, Franco (Université du Québec à Montréal)
Salomaa, Kai (Queen's University)
Shallit, Jeffrey (University of Waterloo)
Simpson, Jamie (Curtin University)
Stoll, Thomas (Universite de La Mediterranee)
Vaslet, Elise (Institut de Mathématiques de Luminy)
Visentin, Terry (University of Winnipeg)
Zamboni, Luca (Université Lyon 1 & University of Turku)

Operator Structures in Quantum Information Theory
February 26-March 2, 2012

Organizers:

Patrick Hayden (McGill University)
Marius Junge (University of Illinois, UC)
David Kribs (University of Guelph)
Mary Beth Ruskai (Tufts University)
Andreas Winter (University of Bristol)

Quantum information science is a rapidly developing interdisciplinary field whose significance ranges from fundamental issues in quantum theory to new state-of-the-art methods for secure transmission of information. Its potential for powerful new methods of computation, data transmission and encryption has transformed such fields as computation complexity, cryptography and the analogue of Shannon's theory for transmitting data in the presence of noise. Work in this highly interdisciplinary area overlaps many different fields of mathematics. This workshop brought together experts on quantum information theory and mathematicians working on operator structures. The first such workshop, held at BIRS in 2007, led to the resolution of several unsolved problems and had a significant impact on the underlying mathematics as well. This 2012 workshop focussed on the role of operator algebras, operator spaces, and operator systems in quantum information theory and, conversely, the impact of quantum information science on these fields.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5084

Participants:

Berta, Mario (ETH Zurich)
Briët, Jop (CWI)
Christandl, Matthias (ETH Zurich)
Collins, Benoît (University of Ottawa)
Cubitt, Toby (Universidad Complutense de Madrid)
Duan, Runyao (University of Technology Sydney)
Eisert, Jens (Free University of Berlin)
Farenick, Douglas (University of Regina)
Fritz, Tobias (ICFO Spain)
Gross, David (ETH Zurich)
Haagerup, Uffe (University of Copenhagen)
Harrow, Aram (Univerity of Washington)
Hastings, Matthew (Duke University)
Hayden, Patrick (McGill University)
Horodecki, Michal (University of Gdansk)
Jencova, Anna (Mathematical Institute of the Slovak Academy of Sciences)
Johnston, Nathaniel (Guelph University)
Junge, Marius (UIUC)
Kalantar, Mehrdad (UICU and Carleton)
Kribs, David (University of Guelph)
Mancinska, Laura (University of Waterloo)
Mosonyi, Milan (National University of Singapore)
Musat, Magdalena (University of Copenhagen)
Navascues, Miguel (University of Bristol)
Ozols, Maris (Institute for Quantum Computing)
Palazuelos, Carlos (Instituto de Ciencias Matemáticas)
Paulsen, Vern (University of Houston)
Pérez-García, David (Complutense University of Madrid)
Ruskai, Mary Beth (Tufts University)
Scholz, Volkher (Leibniz University of Hannover)
Schuch, Norbert (California Institute of Technology)
Severini, Simone (University College London)
Shultz, Fred (Wellesley College)
Smith, Graeme (IBM Research)
Szarek, Stanislaw (Case Western Reserve University)
Szkola, Arleta (Max Planck Institute for Mathematics in the Sciences)
Todorov, Ivan (Queen's University Belfast)
Verstraete, Frank (University of Vienna)
Watrous, John (University of Waterloo)
Weis, Stephan (Max Planck Institute for Mathematics in the Sciences)
Winter, Andreas (University of Bristol)

Banach Space Theory
March 4-9, 2012

Organizers:

Razvan Anisca (Lakehead University)
Steve Dilworth (University of South Carolina)
Edward Odell (University of Texas at Austin)
Bunyamin Sari (University of North Texas)

From the very beginning of Functional Analysis, the general objective of the theory of infinite-dimensional Banach spaces have been mainly to establish a nice structure theory for Banach spaces. The underlying assumption was that the geometry of a Banach space must have a lot of symmetries and therefore one can find nice substructures in it. However, there has been a fundamental shift in our understanding of infinite-dimensional phenomena starting with the discovery of "structureless" (counter)-examples of Gowers and Maurey in the nineties. The new geometric phenomena exhibited by these examples were proved to be prevalent rather than being a few pathological examples. Very recently, Argyros and Haydon discovered an ultimate example; a space which admits no "non-trivial" bounded linear operator. This solves a number of central problems in Functional Analysis.This workshop brought together the leading experts to dissect the remarkable recent progress and discuss the future directions in Banach space theory.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5019

Participants:

Alspach, Dale (Oklahoma State University)
Anisca, Razvan (Lakehead University)
Argyros, Spiros (National Technical University of Athens)
Baudier, Florent (Texas A & M)
Beanland, Kevin (Virginia Commonwealth University)
Castillo, Jesus (Universidad de Extremadura)
Chavez Dominguez, Javier Alejandro (Texas A & M)
Dahal, Koshal (University of North Texas)
Dilworth, Steve (University of South Carolina)
Dosev, Detelin (Weizmann Institute)
Ferenczi, Valentin (Universidade de São Paulo)
Freeman, Daniel (University of Texas at Austin)
Gao, Niushan (University of Alberta)
Gasparis, Ioannis (Aristotle University of Thessaloniki)
Haydon, Richard (University of Oxford)
Johnson, Bill (Texas A & M)
Kaminska, Anna (University of Memphis)
Kutzarova, Denka (UIUC)
Laustsen, Niels (Lancaster University)
Leung, Denny (National University of Singapore)
Manoussakis, Antonis (Technical University of Crete)
Motakis, Pavlos (National Technical University of Athens)
Odell, Edward (The University of Texas at Austin)
Pelczar-Barwacz, Anna (Jagiellonian University)
Popov, Alexey (University of Waterloo)
Randrianantoanina, Beata (Miami University)
Rosendal, Christian (University of Illinois at Chicago)
Rosenthal, Haskell (University of Texas at Austin)
Sari, Bunyamin (University of North Texas)
Schechtman, Gideon (Weizmann Institute)
Schlumprecht, Thomas (Texas A & M)
Spinu, Eugeniu (University of Alberta)
Tarbard, Matthew (University of Oxford)
Tcaciuc, Adi (Grant MacEwan University)
Tikhomirov, Konstantin (University of Alberta)
Tomczak-Jaegermann, Nicole (University of Alberta)
Troitsky, Vladimir (University of Alberta)
Tyros, Kostantinos (University of Toronto)
Zheng, Bentuo (University of Memphis)
Zisimopoulou, Despoina (National Technical University of Athens)
Zsak, Andras (University of Cambridge)

Advances in Hyperkähler and Holomorphic Symplectic Geometry
March 11-16, 2012

Organizers:

Marco Gualtieri (University of Toronto)
Jacques Hurtubise (McGill University)
Daniel Huybrechts (University of Bonn)
Eyal Markman (University of Massachusetts Amherst)
Ruxandra Moraru (University of Waterloo)
Justin Sawon (University of North Carolina)

The main scientific objectives achieved in this workshop include generating a summary and understanding of the recent developments and main questions within the different groups of researchers focusing on hyper-kahler geometry, including the recent work on the Torelli theorem, the algebro-geometric study of holomorphic Lagrangian fibrations, and the study of hypertoric varieties. This meeting introduced new ideas coming from physics in the recent papers of Kapustin-Rozansky-Saulina and Gaiotto-Moore-Neitzke, and created a platform for researchers to work on some of the many open questions resulting from this seminal work. The workshop provided students and postdocs with two parallel opportunities: first, to learn well-established aspects of the theory of holomorphic symplectic and hyperkähler manifolds, and second, to be exposed to the plethora of open questions ripe for investigation, deriving from recent advances in the field.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5126

Participants:

Boalch, Philip (Centre National de la Recherche Scientifique)
Calaque, Damien (ETH Zurich)
Caldararu, Andrei (University of Wisconsin, Madison)
Cautis, Sabin (Columbia University)
Charles, François (Ecole Normale Supérieure)
Cherkis, Sergey (University of Arizona)
Dancer, Andrew (University of Oxford)
Fisher, Jonathan (University of Toronto)
Gualtieri, Marco (University of Toronto)
Hausel, Tamás (EPF Lausanne)
Hurtubise, Jacques (McGill University)
Huybrechts, Daniel (University of Bonn)
Hwang, Jun-Muk (Korea Institute for Advanced Study)
Ingle, Matthew (University of Toronto)
Jeffrey, Lisa (University of Toronto)
Lahoz, Martí (Universitat Bonn)
Lehn, Manfred (Johannes Gutenberg-Universitaet Mainz)
Macrì, Emanuele (The Ohio State University)
Magnusson, Gunnar (Institut Fourier)
Markman, Eyal (University of Massachusetts Amherst)
Markushevich, Dimitri (Universite Lille 1)
Matsushita, Daisuke (Hokkaido University)
Mongardi, Giovanni (Università degli Studi di Roma 3)
Moraru, Ruxandra (University of Waterloo)
Namikawa, Yoshinori (Kyoto University)
Neitzke, Andy (University of Texas at Austin)
O'Grady, Kieran (Rome (Sapienza))
Odesskii, Alexander (Brock University)
Oguiso, Keiji (Osaka University)
Petit, François (UPMC)
Proudfoot, Nicholas (University of Oregon)
Pym, Brent (University of Toronto)
Rayan, Steven (University of Oxford)
Saccà, Giulia (Princeton University)
Sawon, Justin (University of North Carolina)
Scheimbauer, Claudia (ETH Zurich)
Verbitsky, Misha (SU-HSE, Faculty of Maths)
Webster, Ben (University of Oregon)

Challenges and Advances in High Dimensional and High Complexity Monte Carlo Computation and Theory
March 18-23, 2012

Organizers:

David Ceperley (UIUC)
Yuguo Chen (UIUC)
Radu Craiu (University of Toronto)
Xiao-Li Meng (Harvard University)
Antonietta Mira (University of Lugano)
Jeffrey Rosenthal (University of Toronto)

Recent advances in the Monte Carlo field require new theoretical developments to either extend the applicability of existing methods or to generate alternative algorithms more suitable for statistical applications. This workshop helped to meet the theoretical challenges and addressed the increasing demand for more powerful computational tools from the scientific research community. The following objectives were achieved in this meeting: (1) researchers who developed powerful Monte Carlo methods met with scientists whose problems required advanced computational tools. Researchers in physics, chemistry, computer science, genetics and medicine, together with experts in the design and theoretical study of sophisticated Monte Carlo methods such as sequential Monte Carlo, adaptive Monte Carlo, perfect sampling, quantum Monte Carlo, and Markov chain Monte Carlo produced synergy; (2) research within the Monte Carlo community through a generous exchange of ideas was spurred as a natural response to the challenges presented by real applications; and (3) the collaboration between Canadian research centers along with international collaborations were invigorated.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5105

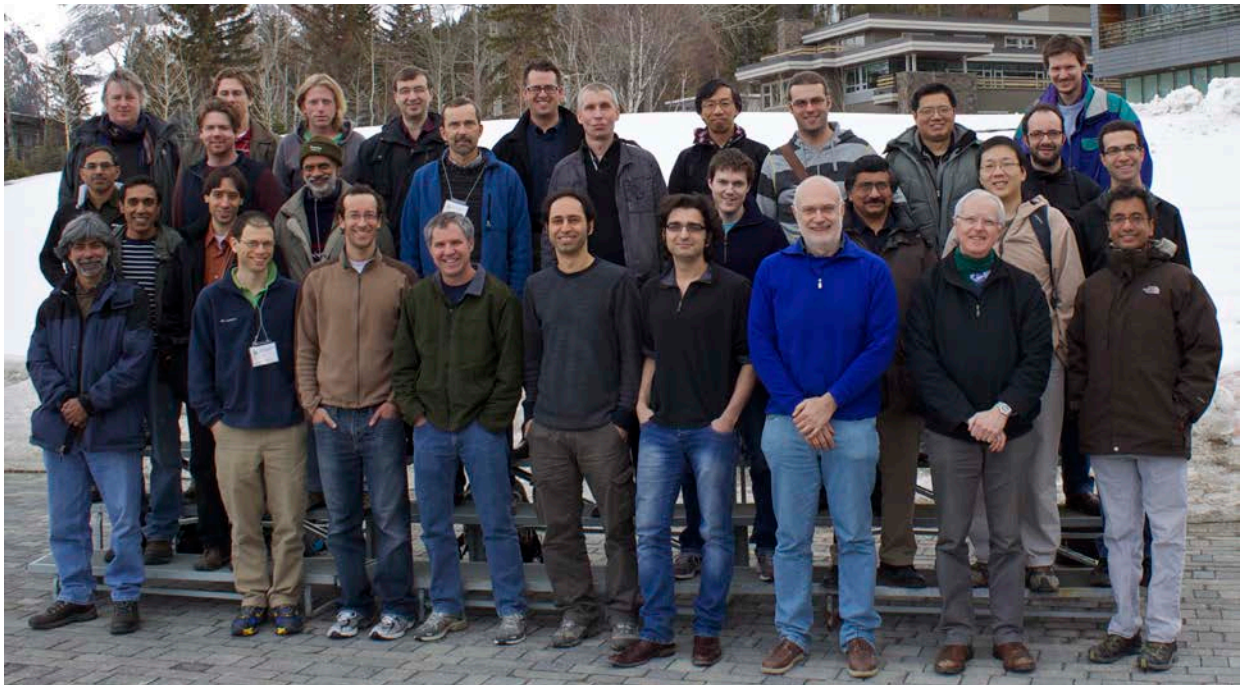
Participants:

Adams, Ryan (Harvard University)
Assaraf, Roland (Université Pierre et Marie Curie)
Astle, William (McGill University)
Blanchet, Jose (Columbia University)
Chen, Yuguo (University of Illinois, UC)
Chen, Rong (Rutgers University)
Craiu, Radu (University of Toronto)
de Freitas, Nando (University of British Columbia)
Dinwoodie, Ian (Portland State University)
Fort, Gersende (Télécom ParisTech)
He, Xuming (University of Michigan)
Hobert, James (University of Florida)
Huber, Mark (Claremont McKenna College)
Jones, Galin (University of Minnesota)
Latuszynski, Krzysztof (University of Warwick)
Leman, Scotland (Virginia Tech)
Liang, Faming (Texas A&M)
Liu, Jun (Harvard University)
Madras, Neal (York University)
Massam, Helene (York University)
Mira, Antonietta (University of Lugano)
Moulines, Eric (Institut Telecom-Mines / Télécom ParisTech)
Murdoch, Duncan (University of Western Ontario)
Parrinello, Michele (Eidgenössische Technische Hochschule Zürich and Università della Svizzera Italiana, Lugano)
Perron, Francois (University of Montreal)
Robert, Christian (Ceremade - Université Paris-Dauphine)
Roberts, Gareth (College of the Holy Cross)
Rosenthal, Jeffrey (University of Toronto)
Sabatti, Chiara (Stanford University)
Sisson, Scott (University of New South Wales)
Tan, Zhiqiang (Rutgers University)
van Dyk, David (Imperial College London)
Woodard, Dawn (Cornell University)
Zhang, Jinfeng (Florida State University)
Zhou, Qing (UCLA)

Algebraic Stacks: Progress and Prospects
March 25-30, 2012

Organizers:

Patrick Brosnan (University of Maryland)
Roy Joshua (Ohio State University)
Hsian-Hua Tseng (Ohio State University)



This workshop combined various camps of mathematicians working in aspects of geometric representation theory, differential graded algebraic geometry, algebraic topology and mathematical physics and who make use of algebraic stacks and stack theoretic techniques from possibly diverse points of view and promoted exchange of ideas between these various camps. The meeting brought together several of the leading experts in related fields along with several post-docs and advanced graduate students working in these areas. The presentations discussed the current state of development and explored prospects for future progress in this area. This conference funded a number of young people, at both the post-doctoral and advanced graduate student level and served to stimulate future interest in these areas. Major workshop highlights included the exploration of various aspects of the intersection theory, K-theory and G-theory of higher and derived stacks.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5027

Participants:

Alper, Jarod (Columbia University)
Arapura, Donu (Purdue University)
Behrend, Kai (University of British Columbia)
Beke, Tibor (University of Massachusetts Lowell)
Bergh, Daniel (Stockholm University)
Brosnan, Patrick (University of Maryland)
Bryan, Jim (University of British Columbia)
Chen, Jiun-Cheng (National Tsing-Hua University)
Dhillon, Ajneet (University of Western Ontario)
Edidin, Dan (University of Missouri)
Geraschenko, Anton (Caltech)
Jarvis, Tyler (Brigham Young University)
Joshua, Roy (Ohio State University)
Kapranov, Mikhail (Yale University)
Kimura, Takashi (Boston University)
Krishna, Amalendu (Tata Institute Of Fundamental Research)
Lieblich, Max (University of Washington)
Lowrey, Parker (UWO)
Mann, Etienne (Universite de Montpellier 2)
Moret-Bailly, Laurent (Université de Rennes 1)
Morrison, Andrew (ETH Zurich)
Nitsure, Nitin (Tata Institute of Fundamental Research)
Noohi, Behrang (University of London)
Perroni, Fabio (Universitaet Bayreuth)
Reichstein, Zinovy (University of British Columbia)
Satriano, Matthew (University of Michigan)
Sheshmani, Artan (University of British Columbia)
Simpson, Carlos (University of Nice)
Sorkin, Adam (University of California Davis)
Tseng, Hsian-Hua (Ohio State University)
Vakil, Ravi (Stanford University)
Vistoli, Angelo (Scuola Normale Superiore di Pisa)
Wise, Jonathan (Stanford University)

Stochastic Analysis and Stochastic Partial Differential Equations
April 1-6, 2012

Organizers:

Robert Dalang Hambleton (Ecole Polytechnique Fédérale de Lausanne University)

Davar Khoshnevisan (University of Utah)
Yimin Xiao (Michigan State University)

For nearly three decades, the topic of stochastic partial differential equations (SPDEs) has been an active area of research in pure and applied mathematics. The enormous amount of current, as well as past, interest in SPDEs is, and was, motivated in part by the vast number of its applications in sciences outside mathematics which, in turn, motivate and generate a large number of new and exciting mathematical questions.

A main objective of this meeting was to bring together experts from SPDEs and Gaussian processes, a more well-developed part of probability theory, as well as researchers working at the interface between these two areas. A second objective was to identify fundamental open problems in the theory of SPDEs that are motivated by mathematical physics and fluid dynamics, particularly the study of turbulence.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5023

Participants:

Balan, Raluca (University of Ottawa)
Cerrai, Sandra (University of Maryland)
Chen, Xia (University of Tennessee)
Chen, Le (EPF-Lausanne)
Chen, Yu-Ting (University of British Columbia)
Conus, Daniel (Lehigh University)
Dalang, Robert (Ecole Polytechnique Fédérale de Lausanne)
Döring, Leif (University of Paris 6)
Grothaus, Martin (University of Kaiserlautern)
Hofmanová, Martina (Ens de Cachan, Antenne de Bretagne)
Hu, Yaozhong (University of Kansas)
Imkeller, Peter (Humboldt University)
Joseph, Mathew (University of Utah)
Khoshnevisan, Davar (University of Utah)
Li, Wenbo (University of Delaware)
Millet, Annie (Université Paris 1 Panthéon Sorbonne)
Mocioalca, Oana (Kent State University)
Mueller, Carl (University of Rochester)
Mytnik, Leonid (Technion)
Nualart, David (University of Kansas)
Quer-Sardanyons, Lluís (Universitat Autònoma de Barcelona)
Röckner, Michael (Universitaet Bielefeld)
Russo, Francesco (ENSTA-Paris Tech)
Tindel, Samy (Universite Henri Poincare)
van Neerven, Jan (Delft University of Techology)
Viens, Frederi (Purdue University)
Walsh, John (University of British Columbia)
Xiao, Yimin (Michigan State University)
Yang, Xue (University of Manchester)
Zähle, Martina (University of Jena)
Zhang, Tusheng (University of Manchester)
Zhang, Liang (University of Utah)

Open Dynamical Systems: Ergodic Theory, Probabilistic Methods and Applications
April 8-13, 2012

Organizers:

Wael Bahsoun (Loughborough University)
Chris Bose (University of Victoria)
Gary Froyland (University of New South Wales)

This conference brought together three groups of scientists: (1)theoretical researchers in ergodic theory, (2) researchers in applied and numerical dynamical systems, and in particular, in fluid dynamics, molecular dynamics and, ocean/atmosphere dynamics; and (3) physicists and mathematicians with expertise in nonequilibrium statistical mechanics. The conference facilitated scientific exchange between these three groups by:
i) bringing natural questions and examples from application areas to ergodic theory researchers to motivate and focus the next generation of theoretical research;
ii) bringing to the applied community a review of state-of-the-art theoretical tools that might be brought to bear on applications; and
iii) identifying the most promising numerical approaches that may be used to connect the theoretical and applied research streams.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5050

Participants:

Bahsoun, Wael (Loughborough University)
Baladi, Viviane (Ecole Normale Superieure, CNRS)
Balasuriya, Sanjeeva (Connecticut College)
Bandtlow, Oscar (Queen Mary, University of London)
Berger, Arno (University of Alberta)
Bollt, Erik (Clarkson University)
Bose, Chris (University of Victoria)
Bruin, Henk (University of Surrey)
Bunimovich, Leonid A. (Georgia Tech.)
Dellnitz, Michael (University of Paderborn)
Demers, Mark (Fairfield University)
Dettmann, Carl (The University of Bristol)
Eslami, Peyman (Concordia University)
Ferguson, Andrew (University of Bristol)
Froyland, Gary (University of New South Wales)
González Tokman, Cecilia (University of Victoria)
Góra, Pawel (Concordia University)
Haydn, Nicolai (University of Southern California)
Islam, Shafiqul (University of Prince Edward Island)
Junge, Oliver (Technische Universität München)
Klages, Rainer (Queen Mary, University of London)
Lin, Kevin (University of Arizona)
Liverani, Carlangelo (University of Rome Tor Vergata)
Lloyd, Simon (University of São Paulo)
Meiss, James (University of Colorado, Boulder)
Melbourne, Ian (University of Surrey)
Murray, Rua (University of Canterbury)
Nicol, Matthew (University of Houston)
Ott, William (University of Houston)
Padberg-Gehle, Kathrin (TU Dresden)
Persson, Tomas (Lund University)
Pollicott, Mark (University of Warwick)
Quas, Anthony (University of Victoria)
Ross, Shane (Virginia Tech.)
Santitissadeekorn, Naratip (University of North Carolina - Chapel Hill)
Sato, Yuzuru (Hokkaido University)
Stuart, Robyn (UNSW)
Terhesiu, Dalia (Università di Roma)
Troubetzkoy, Serge (Institut de Mathématiques de Luminy (UMR 6206))
Tupper, Paul (Simon Fraser University)
Watson, Tom (University of New South Wales)
Yorke, James Alan (University of Maryland)
Zweimüller, Roland (University of Vienna)

Geometric Structures on Manifolds
April 15-20, 2012

Organizers:

Ian Hambleton (McMaster University)
Alexei Kovalev (University of Cambridge)
Ronald Stern (University of California, Irvine)

There has been a lot of progress in recent years in the study of Seiberg-Witten and Yang Mills gauge theory, special geometries arising from Riemannian holonomy reduction, Donaldson-Thomas gauge theory and variants of Floer homology. This workshop brought together researchers from these different, yet related areas of differential topology, geometry and geometric analysis to encourage exchange of ideas and stimulate new research collaborations. The meeting acted as a joint forum for leading experts in these areas and a number of young mathematicians, including finishing PhD students and postdoctoral researchers. Highlights discussed in the workshop included issues on the smooth 4-manifolds, geometry and curvation, the Gauge theory, and higher-dimensional manifolds.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5121

Participants:

Alekseevski, Dmitry (Brno)
Baldridge, Scott (Louisiana State University)
Baykur, Inanc (Brandeis University)
Biquard, Olivier (École Normale Supérieure)
Bryant, Robert (MSRI)
Cavalcanti, Gil (Utrecht University)
Chen, Weimin (University of Massachusetts at Amherst)
Dancer, Andrew (University of Oxford)
Davis, Jim (Indiana University)
Fang, Fuquan (Capital Normal University)
Fintushel, Ronald (Michigan State University)
Gualtieri, Marco (University of Toronto)
Hambleton, Ian (McMaster University)
Hedden, Matthew (Michigan State University)
Hillman, Jonathan (University of Sydney)
Katzarkov, Ludmil (University of Miami)
Kirby, Robion (University of California - Berkeley)
Kirk, Paul (Indiana University)
Kovalev, Alexei (University of Cambridge)
Kreck, Matthias (Bonn University)
Kutluhan, Cagatay (Harvard University)
LeBrun, Claude (State University of New York, Stony Brook)
Lekili, Yanki (University of Cambridge)
Lu, Peng (University of Oregon)
Mares, Ben (McMaster University)
Matic, Gordana (University of Georgia)
Nguyen, Timothy (Simons Center for Geometry and Physics)
Nicolaescu, Liviu (University of Notre Dame)
Nordström, Johannes (Imperial College London)
Palka, Karol (UQAM)
Pedersen, Erik (University of Copenhagen)
Perutz, Tim (University of Texas-Austin)
Pilca, Mihaela (University of Regensburg)
Santoro, Bianca (CUNY)
Saveliev, Nikolai (University of Miami)
Stern, Ronald (University of California, Irvine)
Stipsicz, Andras (Hungarian Academy of Sciences)
Sunukjian, Nathan (Stony Brook University)
Swann, Andrew (University of Aarhus)
Teleman, Andrei (Universite de Provence)
Walpuski, Thomas (Imperial College)
Wehrheim, Katrin (MIT)

Composite Likelihood Methods
April 22-27, 2012

Organizers:

David Firth (University of Warwick)
Harry Joe (University of British Columbia)
Nancy Reid (University of Toronto)
Peter Song (University of Michigan)
Cristiano Varin (Ca' Foscari University)

This workshop
(i) highlighted and expanded the breadth of composite likelihood methods and their potential for inference from complex statistical models for high-dimensional data;
(ii) identified important directions for future research in the theory of composite likelihood, in software development, and in methodology for different application areas;
(iii) facilitated collaboration between theoretical and subject-area researchers; and
(iv) provided opportunities for graduate students and recent Ph.D. recipients to meet and interact with leading researchers in the area. The workshop emphasized current topics that were not covered in detail at the Warwick conference, to reflect the increasing interest in composite likelihood methods in practice. Topics discussed included the following: a) environmental science, geostatistics, image analysis, transportation: data with both spatial and time dependencies; b) Gene regulatory network construction, genetic family data analysis, and analysis of genome wide association studies: high-dimensional data with small sample sizes; c) psychometrics and limited information methods: latent variables and random effects, and more.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5046

Participants:

Bai, Yun (University of Michigan)
Bellio, Ruggero (University of Udine)
Briollais, Laurent (Samuel Lunenfeld Research Inst.)
Carroll, Ray (Texas A&M)
Choi, Yun-Hee (University of Western Ontario)
Davis, Richard (Columbia University)
Davison, Anthony (Ecole Polytechnique Fédérale de Lausanne (EPFL))
de Leon, Alex (University of Calgary)
Diao, Liqun (University of Waterloo)
Firth, David (University of Warwick)
Fraser, Don (University of Toronto)
Gao, Xin (York University)
Genton, Marc (Texas A & M University)
Guolo, Annamaria (University of Verona)
Huser, Raphaël (Ecole Polytechnique Fédérale de Lausanne)
Joe, Harry (University of British Columbia)
Jordan, Helen (University of Warwick)
Kang, Jian (Emory University)
Karlis, Dimitris (Athens University of Economics and Business)
Larribe, Fabrice (UQAM)
Lele, Subhash (University of Alberta)
Lindsay, Bruce (Pennsylvania State University)
Liu, Juxin (University of Saskatchewan)
Ma, Yanyuan (Texas A & M University)
Molenberghs, Geert (Hasselt University)
Moustaki, Irini (London School of Economics)
Ng, Chi Tim (The Chinese University of Hong Kong)
Padoan, Simone (University of Padua)
Reid, Nancy (University of Toronto)
Ribatet, Mathieu (Universite Montpellier II)
Salvan, Alessandra (University of Padova)
Sartori, Nicola (University of Padova)
Song, Peter (University of Michigan)
Varin, Cristiano (Ca' Foscari University)
Vasdekis, Vassilis (Athens University of Economics and Business)
Vidoni, Paolo (University of Udine)
Wang, Naisyin (University of Michigan)
Xu, Ximing (University of Toronto)
Yi, Grace (University of Waterloo)

Manifolds with Special Holonomy and their Calibrated Submanifolds and Connections
April 29-May 4, 2012

Organizers:

Bobby Acharya (Abdus Salam International Center for Theoretical Physics)
Robert Bryant (MSRI)
Spiro Karigiannis (University of Waterloo)
Naichung Conan Leung (CUHK)

The intuition of the physics community has been absolutely essential for so much of the spectacular progress that has been made in differential geometry and algebraic geometry since the 1970's, led by Atiyah, Bott, Witten, Yau, and others, and this continues to be the case. This workshop allowed the geometry community to maintain and expand its dialogue with the physics community for the mutual benefit of both parties. This meeting gathered geometers and physicists and encouraged them to work together in an environment that is ideally suited for making important research advances. A significant number of collaborations have arisen from this workshop. A great number of young researchers, both graduate students and postdoctoral fellows were exposed to current research in the area through this workshop, which enabled them to meet other mathematicians and begin new research projects.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5024

Participants:

Acharya, Bobby (Abdus Salam International Center for Theoretical Physics)
Baraglia, David (Australian National University)
Bazzoni, Giovanni (Universidad Complutense de Madrid)
Bielawski, Roger (University of Leeds)
Chen, Yunxia (Chinese University of Hong Kong)
Cherkis, Sergey (University of Arizona)
Chiossi, Simon G. (Politecnico di Torino)
Conlon, Ronan (McMaster University)
Dunajski, Maciej (Cambridge University)
Fino, Anna (Universita di Torino)
Gayet, Damien (Université Lyon I)
Grigorian, Sergey (Stony Brook University)
Harland, Derek (Loughborough University)
Haskins, Mark (Imperial College London)
Haydys, Andriy (Universitat Bielefeld)
Ionel, Marianty (Federal University of Rio de Janeiro)
Ivey, Thomas (College of Charleston)
Kovalev, Alexei (University of Cambridge)
Lee, JaeHyouk (Ewha Womans Universtiy)
Leung, Naichung Conan (CUHK)
Lotay, Jason (University College London)
McKay, Ben (University College Cork)
Mettler, Thomas (Mathematical Sciences Research Institute)
Nordström, Johannes (Imperial College London)
Pacini, Tommaso (SNS)
Parton, Maurizio (Università di Chieti-Pescara)
Sá Earp, Henrique (Universidade Estadual de Campinas)
Semmelmann, Uwe (University of Stuttgart)
Smith, Aaron (University of Waterloo)
Tsui, Mao-Pei (University of Toledo)
Wang, Mu-Tao (Columbia University)
Warren, Micah (Princeton University)
Witt, Frederik (WWU Münster)
Ye, Rick Rugang (UC, Santa Barbara)
Zhang, Yongsheng (Stony Brook University)

Linking Representation Theory, Singularity Theory and Non-Commutative Algebraic Geometry
May 6-11, 2012

Organizers:

José Antonio de la Peña (Institute of Mathematics at the National Autonomous University of Mexico)
Vlastimil Dlab (Carleton University)
Osamu Iyama (Nagoya University)
Helmut Lenzing (University of Paderborn)

In an earlier workshop, scientists have launched a number of test problems yielding a stress test for the representation theory of finite dimensional algebras, thereby stretching its capabilities to its limits or well beyond. These problems were chosen to provide a focus with a high potential in establishing fresh links to mathematical subjects of neighboring fields. Researchers have been unexpectedly successful in running these stress tests. Not unexpectedly, however, their solutions have paved the way for new and important open questions. And more importantly, they did uncover further unexpected links. Now in this workshop, experts with largely varying backgrounds attacked these new problems in an interdisciplinary fashion. The new challenges were confronted by extending existing, and forming new bridges between three main subjects: finite dimensional representation theory, theory of singularities, and non-commutative (exotic) spaces.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5067

Participants:

Angeleri Huegel, Lidia (Universita degli Studi di Verona)
Beil, Charlie (Simons Center for Geometry and Physics at Stony Brook University)
Broomhead, Nathan (Leibniz University Hannover)
Buchweitz, Ragnar-Olaf (University of Toronto Scarborough)
Chen, Xiao-Wu (USTC Hefei)
Chen, Xueqing (University of Wisconsin-Whitewater)
Dao, Hailong (University of Kansas)
de la Peña, José Antonio (Institute of Mathematics at the National Autonomous University of Mexico)
Dlab, Vlastimil (Carleton University)
Dugas, Alex (University of the Pacific)
Ebeling, Wolfgang (Leibniz Universität Hannover)
Favero, David (University of Vienna)
Geiss, Christof (UNAM)
Happel, Dieter (Technische Universität Chemnitz)
Herschend, Martin (Nagoya University)
Hille, Lutz (University Münster)
Ingalls, Colin (University of New Brunswick)
Iyama, Osamu (Nagoya University)
King, Alastair (University of Bath)
Krause, Henning (University of Bielefeld)
Kussin, Dirk (University of Verona)
Ladkani, Sefi (University of Bonn)
Lenzing, Helmut (University of Paderborn)
Marko, Frantisek (Penn State University Hazleton)
Meltzer, Hagen (University of Szczecin)
Minamoto, Hiroyuki (Kyoto University)
Mori, Izuru (Shizuoka University)
Oppermann, Steffen (Norwegian University of Science and Technology)
Paquette, Charles (University of New Brunswick)
Reiten, Idun (Norwegian University of Science and Technology)
Ringel, Claus Michael (Universitaet Bielefeld)
Schmidmeier, Markus (Florida Atlantic University)
Sisodia, Gautam (University of Washington)
Smith, Paul (University of Washington)
Takahashi, Atsushi (Osaka University)
Ueda, Kazushi (Osaka University)
Unger, Luise (FernUniversität Hagen)
Wemyss, Michael (University of Edinburgh)
Yoshino, Yuji (Okayama University)

Connections Between Regularized and Large-Eddy Simulation Methods for Turbulence
May 13-18, 2012

Organizers:

Eliot Fried (McGill University)
Bernard Geurts (University of Twente)
Bill Layton (University of Pittsburgh)
Robert Moser (University of Texas, Austin)
Ugo Piomelli (Queen's University)

This workshop brought together mathematicians working on regularized models for turbulence and the most active and prominent mathematicians, fluid mechanicians, physicists, and computational scientists working on advanced, cutting-edge methods of large-eddy simulation (where, to make computations feasible, only the most energetically significant modes of flow are taken into consideration). In the past, interaction between these communities had been limited since their members use different terminology and notation. This workshop, in turn, fostered communication between these two communities. Their communication led to the identification of common ground, the cross-fertilization of ideas, and the specification of worthwhile problems. These developments provided a foundation for many fruitful collaborations, which will lead to significant advances in our understanding of turbulence.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5063

Participants:

Berselli, Luigi Carlo (University of Pisa)
Biria, Aisa (McGill University)
Burman, Erik (University of Sussex)
Connors, Jeffery (Lawrence Livermore National Laboratory)
Dallmann, Helene (University of Goettingen)
Duda, Fernando (Federal University of Rio de Janeiro)
Fried, Eliot (McGill University)
Geurts, Bernard (University of Twente)
Giusteri, Giulio (University of Washington)
Graham, Jonathan Pietarila (Los Alamos National Laboratory)
Gustafsson, Jonathan (McMaster University)
Hinz, Denis (McGill University)
Hoffman, Johan (Royal Institute of Technology (KTH))
Iliescu, Traian (Virginia Polytechnic Institute and State University)
John, Volker (Weierstrass Institute for Applied Analysis and Stochastics)
Kim, Tae-Yeon (McGill University)
Kuerten, Hans (Eindhoven University of Technology)
Layton, Bill (University of Pittsburgh)
McCann, Barrett (University of Washington)
Oberai, Assad (Rensselaer Polytechnic Institute)
Rebholz, Leo (Clemson University)
Riley, James (University of Washington)
Röhe, Lars (University of Goettingen)
Titi, Edriss (University of California)
Trias, F.Xavier (Technical University of Catalonia)
Tsogtgerel, Gantumur (McGill University)
van der Geld, C.W.M. (Eindhoven University of Technology)
Verstappen, Roel (University of Groningen)

Optimal Transportation and Differential Geometry
May 20-25, 2012

Organizers:

Alessio Figalli (The University of Texas at Austin) **Young-Heon Kim** (University of British Columbia)

The optimal transportation problem consists in finding the most effective way of moving mass distributions from one place to another, minimizing the transportation cost. Such a concept has been found very useful in understanding various mathematical, physical, and social/economics phenomena, such as geophysical dynamics of the atmosphere and oceans, pattern formation of physical and biological objects, the principal-agent problem in microeconomic theory, to name a few. It has also applications in engineering design problems, image processing and also in computer science. For further development of optimal transportation theory and its applications, it is vital to understand its relation with the geometry of the underlying space where the mass distribution and the target place live. This workshop fostered a discussion of the fundamental aspects of optimal transportation in relation to geometry and allowed leading experts as well as junior researchers to exchange ideas and knowledge, find new collaborations, and identify important open problems and new directions of research. This workshop mainly focussed on the relation between optimal transportation and various curvature notions of geometric spaces.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5118

Participants:

Acciaio, Beatrice (University of Perugia)
Ambrosio, Luigi (Scuola Normale Superiore Pisa)
Bertrand, Jerome (IMT)
Bianchini, Stefano (SISSA)
Brendle, Simon (Stanford University)
Castillon, Philippe (Universite Montpellier 2)
Erbar, Matthias (University of Bonn)
Figalli, Alessio (The University of Texas at Austin)
Ge, Yuxin (Universite Paris Est Creteil)
Gharib, Saman (UBC)
Ghoussoub, Nassif (UBC)
Gigli, Nicola (University of Nice)
Guan, Pengfei (McGill University)
Kim, Young-Heon (University of British Columbia)
Kitagawa, Jun (University of British Columbia)
Kloeckner, Benoît (Université Grenoble 1)
Kolesnikov, Alexander V (Higher School of Economics)
Korman, Jonathan (University of Toronto)
Kuwada, Kazumasa (Ochanomizu University)
Lee, Paul (University of California at Berkeley)
Li, Junfang (University of Alabama at Birmingham)
Liu, Jiakun (Princeton University)
Maximo, Davi (University of Texas)
Merigot, Quentin (Université de Grenoble / CNRS)
Munn, Michael (University of Missouri)
Nguyen, Van-Hoang (Université Pierre et Marie Curie - Paris 6)
Ohta, Shin-ichi (Kyoto Univesity)
Pacini, Tommaso (SNS)
Pass, Brendan (University of Alberta)
Rajala, Tapio (Scuola Normale Superiore Pisa)
Rifford, Ludovic (University of Nice)
Savare, Giuseppe (University of Pavia (Italy))
Trudinger, Neil (Australian National University)
Wang, Yi (Princeton University)
Wei, Guofang (University of California at Santa Barbara)
Wylie, William (Syracuse University)

Frontiers in the Detection and Attribution of Climate Change
May 27-June 1, 2012

Organizers:

Amy Braverman (California Institute of Technology)
Paul Kushner (University of Toronto)
Richard Smith (University of North Carolina Chapel Hill)
Daithi Stone (Lawrence Berkeley National Laboratory)
Claudia Tebaldi (Climate Central)
Michael Wehner (Lawrence Berkeley Lab-Scientific Computing Group)

The workshop focussed on developing and improving the statistical methodology of detection and attribution of climate change (D&A). Scientitists sought ways in which human influence on Earth's climate, and the attendant impacts of climate change on human systems, can be more precisely quantified in light of the latest developments in applied statistics, climate modelling, and Earth observations. Researchers concentrated on the exploration of this topic via lectures, poster presentations, and discussions on three fields: physical climatology (including atmosphere/ocean science, cryospheric science, and hydrology), agricultural science, and epidemiology. These fields heavily rely on applied statistics but use distinct statistical approaches, including treatment of uncertainty and confounding factors. Further, all three fields are deeply concerned with the impacts of anthropogenic climate change but use climate inputs (climate models and earth observations) in distinct ways. This workshop combined expertise in statistical climatology, epidemiology, and agricultural statistics with the aim of initiating the development of new D&A methodologies based on rigorous statistical approaches and using a hierarchy of models, including process based, statistical, and computational models.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5037

Participants:

Anderegg, Bill (Stanford University)
Armstrong, Ben (London School of Hygiene and Tropical Medicine)
Braverman, Amy (Jet Propulsion Laboratory, California Institute of Technology)
Brynjarsdottir, Jenny (SAMSI)
Craigmile, Peter (The Ohio State University)
Delsole, Tim (George Mason University)
Dole, Randall (NOAA Earth System Research Laboratory)
Gillett, Nathan (Canadian Centre for Climate Modelling and Analysis)
Greasby, Tamara (NCAR)
Guttorp, Peter (University of Washington)
Hannart, Alexis (IFAECI, CNRS)
Imbers, Jara (Oxford University)
Kushner, Paul (University of Toronto)
Li, Bo (Purdue University)
Lobell, David (Stanford University)
Mears, Carl (Remote Sensing Systems)
Paciorek, Chris (University of California at Berkeley)
Pall, Pardeep (Lawrence Berkeley National Laboratory)
Rajaratnam, Bala (Stanford University)
Ribes, Aurélien (Météo France - CNRS)
Roberts, Michael (University of Hawaii at Manoa)
Santer, Ben (Lawrence Livermore National Laboratory)
Schlenker, Wolfram (Columbia University)
Schwartz, Joel (Harvard)
Shaby, Ben (UC Berkeley)
Smith, Richard (University of North Carolina Chapel Hill)
Sun, Ying (University of Chicago)
Tebaldi, Claudia (Climate Central)
Thorne, Peter (NCSU)
Tingley, Martin (Harvard University)
Zwiers, Francis (University of Victoria)

Arithmetic Geometry of Orthogonal and Unitary Shimura Varieties
June 3-8, 2012

Organizers:

Fabrizio Andreatta (University of Milano)
Jan Bruinier (TU Darmstadt)
Eyal Goren (McGill University)

One of the main occupations of number theory is the solution of polynomial equations. It is a well-known phenomena that in general, such solutions can only be found in number systems that are larger than the integers and their fractions. The creation and understanding of such number systems can be done with great success using the theory of complex multiplication. This theory uses recent advances in the understanding of representation of groups and also about the manifolds associated with them (the symmetric spaces). Much progress has been made in this area in recent years due to the discoveries of Brocherds and the development of the arithmetic and geometry of Shimura varieties (objects derived from the symmetric spaces). This workshop was devoted to presenting the state of the art in this subject and mapping further topics of central importance.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5011

Participants:

Achter, Jeff (Colorado State University)
Amir-Khosravi, Zavosh (Univerity of Toronto)
Andreatta, Fabrizio (University of Milano)
Attwell-Duval, Dylan (McGill University)
Bruinier, Jan (TU Darmstadt)
Burgos Gil, Jose (ICMAT)
Cheung, Amy (McGill University)
de Shalit, Ehud (Hebrew University of Jerusalem)
Ehlen, Stephan (Darmstadt University)
Eischen, Ellen (Northwestern University)
Fiori, Andrew (McGill University)
Freixas, Gerard (CNRS - Institut de Mathématiques de Jussieu)
Goertz, Ulrich (Universität Duisburg-Essen)
Goren, Eyal (McGill University)
Greenberg, Matthew (University of Calgary)
Helm, David (University of Texas)
Hörmann, Fritz (Albert-Ludwigs-Universität Freiburg)
Howard, Benjamin (Boston College)
Kramer, Jurg (Humboldt University Berlin)
Kudla, Stephen (University of Toronto)
Kuehn, Ulf (Universitaet Hamburg)
Madapusi Pera, Keerthi (Harvard University)
Mok, Chung Pang (McMaster University)
Nicole, Marc-Hubert (Université Aix-Marseille II)
Prasanna, Kartik (University of Michigan)
Rapoport, Michael (Universitat Bonn)
Sankaran, Siddarth (University of Toronto)
Shin, Sug Woo (Massachusetts Institute of Technology)
Smithling, Brian (University of Toronto)
Terstiege, Ulrich (Universitaet Duisburg-Essen)
Vasiu, Adrian (Binghamton University)
Voight, John (University of Vermont)
von Pippich, Anna (Humboldt University Berlin)
Walls, Patrick (University of Toronto)
Wedhorn, Torsten (Paderborn University)
Zemel, Shaul (Darmstadt Technical University)
Zhang, Chao (University of Milano & Leiden University)

Descriptive Set Theory and Functional Analysis
June 17-22, 2012

Organizers:

Edward Effros (UCLA)
George Elliott (University of Toronto)
Ilijas Farah (York University)
Andrew Toms (Purdue University)

Descriptive Set Theory is a means of describing the complexity of various kinds of sets or classification problems in mathematics, while Functional Analysis, roughly, is the analysis of infinite-dimensional vector spaces and the maps which act upon them. These subjects have been connected since at least the 1950s, but research on the boundary between them has recently seen impressive growth and the solution of several long-standing problems. This workshop capitalized on this momentum with a cast of researchers perhaps never before assembled at a single meeting (due to the interdisciplinary nature of the topic). This new mix of experts from both fields produced a vibrant research environment, and led to many new collaborations.The following four topics have been discussed thoroughly at the workshop: (1) Borel reducibility and the complexity of classification problems, (2) measure preserving group actions, (3) Banach spaces, and (4) the structure of C*-algebras--all of which are highlights amongst the realm of the interface of operator algebras, descriptive set theory, and ergodic theory.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5099

Participants:

Ando, Hiroshi (Kyoto University)
Bice, Tristan (Kobe University)
Eckhardt, Caleb (Purdue University)
Effros, Edward (UCLA)
Elliott, George (University of Toronto)
Farah, Ilijas (York University)
Ghasemi, Saeed (York University)
Giordano, Thierry (University of Ottawa)
Hart, Bradd (McMaster University)
Hay, Daniel (University of Toronto)
Hines, Taylor (Purdue)
Houdayer, Cyril (ENS Lyon-CNRS)
Kerr, David (Texas A & M)
Kwiatkowska, Aleksandra (UIUC)
Larsen, Nadia S. (University of Oslo)
Li, Zhiqiang (Fields Institute)
Louveau, Alain (Centre National de la Recherche Scientifique)
Lupini, Martino (York University)
Moore, Justin (Cornell University)
Musat, Magdalena (University of Copenhagen)
Nguyen Van The, Lionel (University of Aix-Marseille)
Niu, Zhuang (Memorial University)
Paulsen, Vern (University of Houston)
Peterson, Jesse (Vanderbilt University)
Phillips, N. Christopher (University of Oregon)
Rordam, Mikael (University of Copenhagen)
Sato, Yasuhiko (University of Oregon)
Shlyakhtenko, Dimitri (University of California, Los Angeles)
Sinapova, Dima (UC Irvine)
Steprans, Juris (York University)
Thomas, Simon (Rutgers University)
Toms, Andrew (Purdue University)
Tornquist, Asger (University of Copenhagen)
Tsankov, Todor (Université Paris 7)
Tucker Drob, Robin (Caltech)
Vaes, Stefaan (Katholieke Universiteit Leuven)
Wassermann, Simon (University of Glasgow)
Watson, Nicola (University of Toronto)
White, Stuart (University of Glasgow)
Winter, Wilhelm (University of Muenster)

Eigenvalues/Singular Values and Fast PDE Algorithms: Acceleration, Conditioning, and Stability
June 24-29, 2012

Organizers:

Oscar Bruno (California Institute of Technology)
Michael Haslam (York University)
Mark Lyon (University of New Hampshire)
Catalin Turc (Case Western Reserve University)

Partial Differential Equation (PDE) theory constitutes a cogent set of theoretical and computational methods that enable qualitative and quantitative understanding in vast areas of science and engineering, including the fields of physics, chemistry, biology, economics and ecology, amongst many others. While many high-quality tools are currently available for the numerical solution of PDEs, a large number of important problems have remained intractable, or nearly so, due to the shear scale of the computer power their solutions require. Most of the difficulties that hinder applicability and/or performance of numerical methods concern a certain mathematical obstacle (known to mathematicians as unfavorable specral distributions) which has an impact across disciplines and methodologies. The advances in computer technology alone will not enable accurate solution of complex scientific PDE problems.The mathematical problems considered in this workshop lie at the core of such difficulties. The participants of this workshop included some of the most highly recognized international experts in the field; thus, researchers are confident that the outcome of this workshop will help to greatly advance the state of the art in the field of computational science, and will have a significant impact on science and engineering in years to come.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5021

Participants:

Akhmetgaliyev, Eldar (California Institute of Technology)
Albin, Nathan (Kansas State University)
Antoine, Xavier (Université de Lorraine)
Betcke, Timo (University College London)
Braverman, Elena (University of Calgary)
Bruno, Oscar (California Institute of Technology)
Chandler-Wilde, Simon (University of Reading)
Chen, Yanlai (University of Massachusetts Dartmouth)
Christara, Christina (University of Toronto)
Costabel, Martin (University of Rennes)
Dauge, Monique (University of Rennes)
Dominguez, Victor (Public University of Navarre)
Driscoll, Tobin (University of Delaware)
Ganesh, Mahadevan (Colorado School of Mines)
Gelb, Anne (Arizona State University)
Hagstrom, Tom (Southern Methodist University)
Haslam, Michael (York University)
Henshaw, William (Lawrence Livermore National Laboratory)
Jin, Shi (Shanghai Jiao Tong University & University of Wisconsin)
Kim, Tatiana (University of Bath)
Langdon, Stephen (University of Reading)
Lau, Stephen (University of New Mexico)
Levadoux, David (ONERA)
Leykekhman, Dmitriy (University of Connecticut)
Lyon, Mark (University of New Hampshire)
Melenk, Markus (Vienna University of Technology)
Monk, Peter (University of Delaware)
Nave, Jean-Christophe (McGill University)
Nigam, Nilima (Simon Fraser University)
Ovall, Jeffrey (University of Kentucky)
Platte, Rodrigo (Arizona State University)
Sayas, Francisco-Javier (University of Delaware)
Shipman, Stephen (Louisiana State University)
Shirokoff, David (McGill University)
Siegel, Michael (New Jersey Institute of Technology)
Spence, Euan (University of Bath)
Tausch, Johannes (Southern Methodist University)
Turc, Catalin (Case Western Reserve University)
Wright, Grady (Boise State University)

Torsion in the Homology of Arithmetic Groups: Geometry, Arithmetic, and Computation
July 1-6, 2012

Organizers:

Francesco Calegari (Northwestern University) **Akshay Venkatesh** (Stanford University)
Paul Gunnells (University of Massachusetts Amherst)

This workshop brought together computational number theorists and geometers, especially workers in the Langlands program and experts in geometry and analysis on noncompact manifolds, and explored these new directions in geometry and number theory. The workshop focussed on the interaction between these groups of researchers to engender cross-fertilization and new and unusual collaborations. Most of these developments are very recent and this workshop occurred at a prime time, offering a first time meeting place to focus on them. This workshop brought together a group of researchers in these areas who will lead significant breakthroughs in current research programs, and have uncovered new connections between these topics.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5075

Participants:

Bergeron, Nicolas (Institut de Mathematiques de Jussieu)
Calegari, Francesco (Northwestern University)
Chinta, Gautam (City College of New York)
Church, Thomas (Stanford University)
Doud, Darrin (Brigham Young University)
Dunfield, Nathan (UIUC)
Elbaz-Vincent, Phillipe (Grenoble University)
Ellenberg, Jordan (University of Wisconsin)
Gee, Toby (Imperial College London)
Geraghty, David (Princeton University)
Gunnells, Paul (University of Massachusetts Amherst)
Koch, Sophie (Vienna)
Lipnowski, Michael (Stanford University)
Marshall, Simon (Northwestern University)
Muller, Werner (Universitat Bonn)
Page, Aurel (Université Bordeaux 1)
Pollack, David (Wesleyan University)
Rahm, Alexander D. (National University of Ireland at Galway)
Raimbault, Jean (Université Pierre et Marie Curie (Paris 6))
Savitt, David (University of Arizona)
Sengun, Mehmet Haluk (University of Warwick)
Speh, Birgit (Cornell University)
Venkatesh, Akshay (Stanford University)
Voight, John (University of Vermont)
Wong, Siman (University of Massachusetts Amherst)
Yasaki, Dan (The University of North Carolina at Greensboro)

Interactions Between Continuous and Discrete Holomorphic Dynamical Systems
July 8-13, 2012

Organizers:

Han Peters (University of Amsterdam)

Erlend Fornaess Wold (University of Oslo)

The workshop brought together researchers from continuous and discrete holomorphic dynamical systems, and strengthened the ties between the two parts of the field. In the last decade, strong new connections between the two areas have been found. The goal of the workshop was to explore these connections, and have researchers from both subfields benefit from the expertise of researchers in the other subfield. Over the recent years, there have been very important developments on invariant currents, potential theory and applications to iteration problems, largely due to Dihn, Sibony, de Thelin and Vigny. An example is the introduction of super potentials and the development of current calculus due to Dihn and Sibony.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5051

Participants:

Abate, Marco (Universita di Pisa)
Bedford, Eric (Indiana University)
Bisi, Cinzia (Universita Ferrara)
Bonifant, Araceli (University of Rhode Island)
Boyd, Suzanne (Hruska) (University of Wisconsin Milwaukee)
Bracci, Filippo (Università di Roma)
Diller, Jeffrey (University of Notre Dame)
Dinh, Tien-Cuong (Institut de Mathématique de Jussieu)
Firsova, Tanya (Stony Brook)
Gignac, William (University of Michigan)
Kaschner, Scott (Indiana University Purdue University Indionapolis)
Lapan, Sara (University of Michigan)
Lin, Jan-Li (Indiana Unviersity)
Lyubich, Mikhail (Stony Brook University)
Lyubich, Lilia (Stony Brook University)
McDuff, Dusa (Stony Brook University)
Milnor, John (SUNY at Stony Brook)
Oguiso, Keiji (Osaka University)
Pereira, Jorge Vitório (IMPA (Brazil))
Peters, Han (University of Amsterdam)
Radu, Remus (Cornell University)
Raissy, Jasmin (University of Milano Bicocca)
Roeder, Roland (IUPUI)
Sibony, Nessim (Université Paris-Sud-Bat 425)
Smith, Douglas (University of Notre Dame)
Taflin, Johan (University of Oslo)
Tanase, Raluca (Cornell University)
Ueda, Tetsuo (Kyoto University)
Uehara, Takato (Niigata University)
Vivas, Liz (Purdue University)
Wold, Erlend Fornaess (University of Oslo)
Wulcan, Elizabeth (Chalmers University of Technology)
Zhang, De-Qi (National University of Singapore)

Rigidity Theory: Progress, Applications and Key Open Problems
July 15-20, 2012

Organizers:

Robert Connelly (Cornell University)
Tibor Jordan (Eotvos University, Budapest)
Stephen Power (University of Lancaster)
Ileana Streinu (Smith College)
Walter Whiteley (York University)

Some key factors in the recent accelerated progress have been: (i) the arrival of a new generation of researchers, at multiple centers around the world; (ii) insights and new questions coming from fields of application; and (iii) the evolving community and interactions of people from multiple communities which has been supported by a series of small and medium sized gatherings. Two of the gatherings contributing to these developments were previous meetings at BIRS, which had a strong focus on applications to protein rigidity and flexibility, with added two day gatherings related to the more general mathematical theory of rigidity and flexibility. Whereas, for this meeting, scientists focussed on developments within rigidity theory itself over the range of concepts and structures outlined above.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5069

Participants:

Alfakih, Abdo (University of Windsor)
Borcea, Ciprian (Rider University)
Bowers, John (University of Massachusetts)
Chavez, Laura (Universidad Autonoma Metropolitana)
Cheng, Jialong (University of Florida)
Connelly, Robert (Cornell University)
Crapo, Henry (Centre de recherche “Les moutons matheux”)
Finbow-Singh, Wendy (St. Mary’s University)
Fowler FRS, Patrick (University of Sheffield, England)
Gaifullin, Alexander (Steklov Mathematical Institute)
Gortler, Steven (Harvard University)
Guest, Simon (University of Cambridge)
Hempel, Maria (ETH Zurich)
Jackson, Bill (University of London)
Jordan, Tibor (Eotvos University)
Karpenkov, Oleg (TU Gratz)
Kaszanitzky, Viktória (Eötvös Loránd University)
Kiraly, Csaba (Eotvos University)
Kitson, Derek (Trinity College Dublin)
Lee-St.John, Audrey (Mount Holyoke)
Malestein, Justin (Temple University)
Micheletti, Andrea (Università di Roma Tor Vergata)
Nguyen, Viet Hang (University of Grenoble)
Nixon, Tony (University of Bristol)
Owen, John (Siemans)
Pak, Igor (University of California at Los Angeles)
Power, Stephen (University of Lancaster)
Schröcker, Hans-Peter (University of Innsbruck)
Schulze, Bernd (York University)
Servatius, Brigitte (Worcester Polytechnic Institute)
Servatius, Herman (WPI)
Sitharam, Meera (University of Florida)
So, Anthony Man-Cho (CUHK)
Stachel, Hellmuth (Technische Universität Wien)
Streinu, Ileana (Smith College)
Tanigawa, Shin-ichi (Kyoto University)
Tay, Tiong-Seng (National University of Singapore)
Theran, Louis (Freie Universität Berlin)
Thorpe, Michael (Arizona State University)
Whiteley, Walter (York University)

Tissue Growth and Morphogenesis: from Genetics to Mechanics and Back
July 22-27, 2012

Organizers:

Christian Dahmann (Max Planck Institute of Molecular Cell Biology and Genetics)

James J. Feng (University of British Columbia)
Leonid Pismen (Technion)

This workshop brought together leading scientists from different disciplines to present and discuss the most recent advances at the interfaces between developmental biology, physics and mathematics. Shape and size are characteristic traits of humans, animals and plants. How organisms achieve their final form and size has fascinated biologists for centuries. We now know that genes provide the blueprint for constructing each living organism. Yet, how this blueprint is executed during the development of an organism is still much of a mystery. Like shaping matter of the physical world, shaping the tissues and organs of developing embryos depends on their mechanical properties and the generation of forces. Recent technological advances now allow researchers to measure the mechanical properties of cells and developing embryos, and the forces generated. These exciting advances allow us, for the first time, to connect the genetic blueprint with the physical properties of cells, tissues, and embryos.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5048

Participants:

Aronson, Igor (Argonne National Laboratory)
Brodland, Wayne (University of Waterloo)
Dahmann, Christian (Max Planck Institute of Molecular Cell Biology and Genetics)
Discher, Dennis (University of Pennsylvania)
Fabry, Ben (Erlangen University)
Farge, Emmanuel (Institut Curie)
Feng, James J. (University of British Columbia)
Gorfinkiel, Nicole (Centro de Biología Molecular (Madrid))
Goriely, Alain (University of Oxford)
Gov, Nir (Weizmann Institute)
Hamant, Olivier (Ecole Normale Suprieure de Lyon)
Harris, Tony (University of Toronto)
Honda, Hisao (Hyogo University)
Hutson, Shane (Vanderbilt University)
Ji, Baohua (Beijing Institute of Technology)
Käs, Josef A. (University of Leipzig)
Keller, Ray (University of Virginia)
Kiehart, Dan (Duke University)
Koepf, Michael (Technion)
Lin, Yuan (University of Hong Kong)
Lubkin, Sharon (North Carolina State University)
MacKintosh, Fred (Vrije Universiteit)
Marchetti, M Cristina (Syracuse University)
Martin, Adam (MIT)
Montell, Denise (Johns Hopkins University)
Munoz, Jose (Universitat Politecnica de Catalunya)
Pismen, Leonid (Technion)
Rejniak, Katarzyna (Moffitt Cancer Center & Research Insitute)
Schwarz, Ulrich (University of Heidelberg)
Shaevitz, Joshua (Princeton University)
Silberzan, Pascal (Institut Curie)
Solon, Jerome (Centre for Genomic Regulation)
Trepat, Xavier (Institute for Bioengineering of Catalonia)
Umetsu, Daiki (TU Dresden)
Vavylonis, Dimitrios (Lehigh University)
Wang, Qiming (UBC)
Wasteneys, Geoffrey (UBC)
Weihs, Daphne (Technion)
Weitz, David (Harvard University)
Zallen, Jennifer (Sloan-Kettering Institute)
Zelzer, Elazar (Weizmann Institute of Science)

Conformal and CR geometry
July 29-August 3, 2012

Organizers:

Spyros Alexakis (University of Toronto)
Robin Graham (University of Washington)
Kengo Hirachi (University of Tokyo)
Paul Yang (Princeton University)

This workshop brought together researchers from a variety of backgrounds who find common ground in conformal and CR geometry to report on recent progress and to stimulate further developments. The subject remains extremely fertile, with important recent progress opening up new questions. Areas of focus included the following: (1) algebraic questions and asymptotics, (2) index theory related to conformal/CR geometry,
(3) geometric analysis in the conformal/CR setting, and (4) the study of Poincare-Einstein manifolds. Many of the recent developments have their conceptual roots in the celebrated Atiyah-Patodi-Singer heat kernel proof of the index theorem. This already brought together in an essential way geometric analysis, index theory, formal asymptotics, and algebra in the form of classical invariant theory. Another major recent development involving invariants is Alexakis' resolution of the Deser-Schwimmer conjecture concerning integral invariants in conformal geometry. This too involved the introduction of new methods which have not yet been digested, due partly to their complexity.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5072

Participants:

Ache, Antonio (University of Wisconsin)
Albin, Pierre (UIUC)
Alexakis, Spyros (University of Toronto)
Bahuaud, Eric (Stanford University)
Čap, Andreas (University of Vienna)
Case, Jeffrey (Princeton University)
Chang, Alice (Princeton University)
Chanillo, Sagun (Rutgers University)
Cheng, Jih-Hsin (Academia Sinica Taipei)
Dai, Xianzhe (University of California, Santa Barbara)
di Cerbo, Luca (Duke University)
Eastwood, Michael (Australian National University)
González, Maria Del Mar (Universita' Politecnica de Barcelona (Spain))
Gover, A. Rod (University of Auckland)
Graham, Robin (University of Washington)
Guillarmou, Colin (ENS Paris)
Gursky, Matthew (University of Notre-Dame)
Hammerl, Matthias (University of Vienna)
Hirachi, Kengo (University of Tokyo)
Jakobson, Dmitry (Mc Gill University)
Jeffres, Thalia (Wichita State University)
Juhl, Andreas (University Uppsala)
Lu, Zhiqin (University of California, Irvine)
Madani, Farid (University of Regensburg)
Malchiodi, Andrea (International School for Advanced Studies (SISSA))
Matsumoto, Yoshihiko (The University of Tokyo)
McKeown, Stephen (University of Washington)
McLellan, Brendan (Centre for Quantum Geometry of Moduli Spaces)
Neusser, Katharina (Australian National University)
Nurowski, Pawel (University of Warsaw)
Ørsted, Bent (Aarhus University)
Qing, Jie (University of California, Santa Cruz)
Reichert, Nicholas (Princeton University)
Sagerschnig, Katja (Australian National University)
Slovak, Jan (Masaryk University)
Somberg, Petr (Charles University (Prague))
Soucek, Vladimir (Charles University (Prague))
Sparling, George (University of Pittsburgh)
The, Dennis (Australian National University)
Wang, Yi (Princeton University)
Willse, Travis (Australian National University)
Yang, Paul (Princeton University)

Recent Trends in Geometric and Nonlinear Analysis
August 5-10, 2012

Organizers:

Emmanuel Hebey (Universite Cergy Pontoise)

Frédéric Robert (Universite Henri Poincare Nancy 1)

Geometric analysis is traditionally and by definition at the intersection of pdes and differential geometry. This specifity is one of the richnesses of the field. Indeed, geometric analysis has always taken advantage of the trends either in analysis or in geometry, and vice versa, its own progresses have been a source of new developments and techniques in its two natural constitutive fields. This workshop provided a meeting platform between experts in some of the fields that are not straightforwardly related (at least at first glance), which is benefic for the geometric analysis community. Key themes discussed in the workshop included, conformal geometry, general relativity, geometric evolution equations, singulariti complex structures, and Kahler geometry.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5100

Participants:

Bandara, Lashi (Australian National University)
Chang, Alice (Princeton University)
Chau, Albert (University of British Columbia)
Chen, Shibing (University of Toronto)
Cirstea, Florica (University of Sydney)
Cowan, Craig (Stanford University)
Daniel, Benoit (Université de Lorraine)
del Pino, Manuel (University of Chile)
Druet, Olivier (Ecole Normale Supérieure de Lyon & CNRS)
Fazly, Mostafa (University of British Columbia)
Fraser, Ailana (University of British Columbia)
Ghoussoub, Nassif (University of British Columbia)
Guan, Pengfei (McGill University)
Gui, Changfeng (University of Connecticut)
Hijazi, Oussama (Université de Lorraine, Nancy 1)
Kim, Young-Heon (University of British Columbia)
Kitagawa, Jun (University of British Columbia)
Laurain, Paul (Université Paris 7)
Madani, Farid (University of Regensburg)
Malchiodi, Andrea (International School for Advanced Studies (SISSA))
McCann, Robert (University of Toronto)
Meeks, William (University of Massachusetts)
Moore, Kristen (Albert-Einstein Institute Potsdam)
Moser, Roger (University of Bath)
Musso, Monica (Universidad Católica de Chile)
Pass, Brendan (University of Alberta)
Robert, Frédéric (Universite Henri Poincare Nancy 1)
Veronelli, Giona (Université de Cergy-Pontoise)
Vétois, Jérôme (University of Nice - Sophia Antipolis)
Wei, Juncheng (Chinese University of Hong Kong)
Weth, Tobias (University of Frankfurt)
Yang, Paul (Princeton University)
Zhang, Xiangwen (McGill University)

Syzygies in Algebraic Geometry, with an Exploration of a Connection with String Theory
August 12-17, 2012

Organizers:

Lawrence Ein (University of Illinois at Chigago)
David Eisenbud (University of California, Berkeley)
Gavril Farkas (Humboldt Universität zu Berlin)
Irena Peeva (Cornell University)

The first focus of the workshop was based on the amazing convergence of interest in Cohen-Macaulay modules (especially matrix factorizations and their generalizations) between the String Theory community and the Commutative Algebra/Algebraic Geometry community. The relatedness of these areas was not easy to penetrate, so at this meeting, one long lecture each day was delivered, exposing this subject from multiple points of view. The workshop was a defining moment in this subject. In this workshop, researchers have also discussed the recent development in the theory of syzygies, involving the notion of asymptotic regularity of an ideal. The work of Lazarsfeld, Ein, and Cutkosky connected this to interesting invariants of line bundles on varieties, and has uncovered some very surprising behavior.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5117

Participants:

Aprodu, Marian (Inst. Math. Romanian Academy)
Aspinwall, Paul (Duke University)
Avramov, Luchezar (University of Nebraska)
Berenstein, David (University of California at Santa Barbara)
Berkesch, Christine (Duke University)
Boij, Mats (KTH Royal Institute of Technology)
Burke, Jesse (Bielefeld University)
Caldararu, Andrei (University of Wisconsin, Madison)
Conca, Aldo (University of Genova)
Coskun, Izzet (UIC)
Cutkosky, Steven Dale (University of Missouri)
Dao, Hailong (University of Kansas)
Ein, Lawrence (University of Illinois at Chigago)
Eisenbud, David (University of California, Berkeley)
Erman, Daniel (University of Michigan)
Farkas, Gavril (Humboldt Universität zu Berlin)
Floystad, Gunnar (University of Bergen, Norway)
Hartshorne, Robin (UC Berkeley)
Katz, Sheldon (University of Illinois)
Kloosterman, Remke (Humboldt Universitaet zu Berlin)
Lazarsfeld, Robert (University of Michigan)
Morrison, David (University of California Santa Barbara)
Murfet, Daniel (UCLA)
Mustopa, Yusuf (Boston College)
Niu, Wenbo (Purdue University)
Ottaviani, Giorgio (University of Florence)
Paul, Stepan (University of California Santa Barbara)
Peeva, Irena (Cornell University)
Popa, Mihnea (University of Illinois at Chicago)
Rossi, Maria-Evelina (University of Genova)
Roth, Mike (Queen's University)
Sam, Steven (MIT)
Schenck, Hal (University of Illinois)
Schreyer, Frank-Olaf (Universittaet des Saarlandes, Germany)
Sharpe, Eric (Virginia Tech)
Shipman, Ian (MIT)
Smith, Gregory (Queen's University)
Stillman, Mike (Cornell University)
v. Bothmer, Hans-Christian (Universität Hamburg)
Walker, Mark (University of Nebraska-Lincoln)
Zhou, Xin (University of Michigan)

New Trends and Directions in Combinatorics
August 19-24, 2012

Organizers:

Penny Haxell (University of Waterloo)
Michael Krivelevich (Tel Aviv University)
Benjamin Sudakov (UCLA)

The workshop focussed on several major research topics in modern Combinatorics: Extremal Problems for Graphs and Set Systems, the Ramsey Theory, Combinatorial Number Theory, Combinatorial Geometry, Random Graphs, and Probabilistic Methods. In this workshop, scientists reported and discussed recent advances in these various subfields, and reached further progress in these specific directions, and encouraged collaboration between the fields and rapid dissemination of advanced methods and concepts. Emphasis was placed on the exchange of ideas between researchers from the different areas, and on informal discussion between them. This forum made the state-of-the-art more accessible to a broader audience, in particular, the participation of graduate students in the workshop.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5001

Participants:

Addario-Berry, Louigi (McGill University, Canada)
Balogh, Jozsef (University of Illinois at Urbana)
Bohman, Thomas (Carnegie Mellon University)
Conlon, David (University of Oxford)
Das, Shagnik (UCLA)
Ellis, David (Queen Mary, University of London)
Fox, Jacob (Massachusetts Institute of Technology)
Friedgut, Ehud (Hebrew University)
Frieze, Alan (Carnegie Mellon University)
Furedi, Zoltan (University of Illinois at Urbana)
Gebauer, Heidi (Eidgenssische Technische Hochschule Zurich)
Hatami, Hamed (McGill University)
Haxell, Penny (University of Waterloo)
Hefetz, Dan (University of Birmingham)
Huang, Hao (UCLA)
Kahn, Jeff (Rutgers University)
Kim, Jeong Han (Yonsei University)
Kostochka, Alexandr (UIUC)
Krivelevich, Michael (Tel Aviv University)
Lee, Choongbum (UCLA)
Linial, Nathan (Hebrew University)
Loh, Po-Shen (Carnegie Mellon University)
Lubetzky, Eyal (Microsoft Research)
Luczak, Tomasz (Adam Mickiewicz University)
Ma, Jie (UCLA)
Mubayi, Dhruv (University of Illinois at Chicago)
Naves, Humberto (UCLA)
Pikhurko, Oleg (Carnegie Mellon University)
Reed, Bruce (McGill University)
Schacht, Mathias (University of Hamburg)
Shapira, Asaf (Georgia Institute of Technology)
Solymosi, Jozsef (UBC)
Sudakov, Benjamin (UCLA)
Szabo, Tibor (Freie Universität Berlin)
Tetali, Prasad (Georgia Institute of Technology)
Verstraete, Jacques (UC, San Diego)
Warnke, Lutz (University of Oxford)
Wormald, Nick (University of Waterloo)
Yuster, Raphael (University of Haifa)
Zhao, Yi (Georgia State University)

The Geometry of Scattering Amplitudes
August 26-31, 2012

Organizers:

Nima Arkani-Hamed (Institute for Advanced Study)
Zvi Bern (UCLA)
Alexander Goncharov (Yale University)
Lionel Mason (Oxford University)
David Skinner (Perimeter Institute for Theoretical Physics)

The scattering amplitudes that are the subject of the experiments in the LHC collider in CERN are also a source of much intriguing new mathematics and mathematical physics. In the past, they were computed using Feynman diagrams whose complexity increases so rapidly that they were thought only to be amenable to numerical methods. However, recently they have been discovered to have many remarkable hidden symmetries and structures that not only link them to classical areas of algebraic geometry, integrable systems and invariant theory, but also lead to dramatic simplifications of the structures involved. This has led to substantial progress on the analytic side. This meeting focussed on these newly discovered structures that promise to yield not only new developments in mathematics, but also remarkable new insights into the nature of the underlying physical theories.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5053

Participants:

Adamo, Tim (University of Oxford)
Belitsky, Andrei (Arizona State University)
Bern, Zvi (UCLA)
Bourjaily, Jacob (Harvard University)
Bullimore, Mathew (University of Oxford)
Cachazo, Freddy (Perimeter Institute)
Caron-Huot, Simon (Institute for Advanced Study)
Carrasco, John Joseph (Stanford University)
Dixon, Lance (SLAC National Accelerator Laboratory)
Drummond, James (CERN)
Freedman, Dan (MIT)
Goncharov, Alexander (Yale University)
Green, Michael (Cambridge University)
Henn, Johannes (Institute for Advanced Study)
Hodges, Andrew (University of Oxford)
Huang, Yu-tin (UCLA)
Johansson, Henrik (CEA Saclay)
Kapranov, Mikhail (Yale University)
Korchemsky, Gregory (CEA Saclay)
Lipstein, Arthur (University of Oxford)
Mason, Lionel (Oxford University)
O'Connell, Donal (Niels Bohr International Academy)
Seo, Jihye (McGill University)
Sever, Amit (Institute for Advanced Study, Princeton)
Skinner, David (Perimeter Institute for Theoretical Physics)
Sokatchev, Emery (LAPTH Universite de Savoie)
Sparling, George (University of Pittsburgh)
Trnka, Jaroslav (Princeton University)
Vanhove, Pierre (Institut des Hautes Etudes Scientifiques)
Vergu, Cristian (ETH Zurich)
Vieira, Pedro (Perimeter Institute for Theoretical Physics)

Groups and Geometries
September 2-7, 2012

Organizers:

Inna Capdeboscq (University of Warwick)
Martin Liebeck (Imperial College London)
Bernhard Muhlherr (University of Giessen)
Gernot Stroth (University of Halle, Germany)

The meeting focussed on the theory of finite simple groups, on new developments in geometry related to group theory, and on applications to other areas of mathematics. As groups are just the mathematical way to investigate symmetries, it is clear that a significant number of problems from various areas of mathematics can be translated into specialized problems about finite permutation groups, linear groups, algebraic groups, and so on. The research proposed in the workshop fell into three main areas: (1) new approaches to the classification of finite simple groups and related topics, (2) the approach of the Meierfrankenfeld-Stellmacher-Stroth program (MSS), and (3) the development in finite group theory called fusion systems.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5034

Participants:

Aschbacher, Michael (California Institute of Technology)
Baumeister, Barbara (Universitaet Bielefeld)
Burness, Tim (University of Southampton)
Capdeboscq, Inna (University of Warwick)
Caprace, Pierre-Emanuel (Universite Catholique de Louvain)
Chermak, Andrew (Kansas State University)
Cohen, Arjeh (Eindhoven)
Decelle, Sophie (Imperial College)
Devillers, Alice (University of Western Australia)
Foote, Richard (University of Vermont)
Gill, Nick (Open University)
Giudici, Michael (University of Western Australia)
Grimm, Mathias (Universität Halle)
Grüninger, Matthias (Universite Catholique de Louvain)
Guralnick, Robert (USC)
Hall, Jonathan I. (Michigan State University)
Henke, Ellen (University of Copenhagen)
Horn, Max (Technische Universität Braunschweig)
Ivanov, Alexander (Imperial College London)
Kantor, William (University of Oregon)
Liebeck, Martin (Imperial College London)
Magaard, Kay (University Birmingham)
Malle, Gunter (TU Kaiserslautern)
Morgan, Luke (University of Birmingham)
Muhlherr, Bernhard (University of Giessen)
Parker, Chris (University of Birmingham)
Parmeggiani, Gemma (Universita degli studi di Padova)
Praeger, Cheryl (University of Western Australia)
Pyber, Laci (Renyi Institute of Mathematics Budapest)
Solomon, Ronald Mark (The Ohio State University)
Steinbach, Anja (Justus Liebig University Giessen)
Stellmacher, Bernd (Universitaet Kiel)
Stroth, Gernot (University of Halle, Germany)
Struyve, Koen (Universitat Gent)
Testerman, Donna (École Polytechnique Fédérale de Lausanne)
Tiep, Pham Huu (University of Arizona)
Timmesfeld, Franz (Universität Gießen)
Toborg, Imke (Universität Halle)
Van Maldeghem, Hendrik (Ghent University)
Waldecker, Rebecca (Universität Halle)
Weiss, Richard (Tufts University)
Wilson, Robert (Queen Mary London)

Evolution Equations of Physics, Fluids, and Geometry: Asymptotics and Singularities
September 9-14, 2012

Organizers:

James Colliander (University of Toronto)
Stephen Gustafson (University of British Columbia)
Slim Ibrahim (University of Victoria)
Nader Masmoudi (Courant Institute)
Kenji Nakanishi (Kyoto University)
Tai-Peng Tsai (University of British Columbia)

Nonlinear evolution equations model dynamical processes throughout the sciences: from quantum systems, to the formation of black holes; from turbulence in fluids, to the collapse of a laser beam. It is a major mathematical challenge to understand basic properties - such as the formation of singularities, or the long-time behaviour - of solutions of such equations, and one which calls for a wide variety of mathematical tools, ranging from computer simulations to deep theoretical analysis. This workshop brought together leading experts on such equations, from around the world, who aimed to learn and improve upon state-of-the-art knowledge in this field, and ultimately furthered the understanding of the diverse underlying physical phenomena.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5137

Participants:

Akahori, Takafumi (Shizuoka University)
Akhunov, Timur (University of Calgary)
Bejenaru, Ioan (University of California, San Diego)
Bizon, Piotr (Jagiellonian University)
Craig, Walter (McMaster University)
Czubak, Magdalena (Binghamton University (SUNY))
de Suzzoni, Anne-Sophie (Universite de Cergy Pontoise)
Ettinger, Boris (University of California, Berkeley)
Geba, Dan (University of Rochester)
Gerard, Patrick (Université Paris-Sud)
Germain, Pierre (New York University)
Gustafson, Stephen (UBC)
Ibrahim, Slim (University of Victoria)
Kirkpatrick, Kay (University of Illinois)
Kishimoto, Nobu (Kyoto University)
Koch, Gabriel (University of Sussex)
Li, Dong (University of British Columbia)
Miura, Hideyuki (Osaka University)
Mizumachi, Tetsu (Kyushu University)
Murphy, Jason (UCLA)
Nakanishi, Kenji (Kyoto University)
Oh, Tadahiro (Choonghong) (Princeton University)
Pocovnicu, Oana (Princeton University)
Roy, Tristan (Kyoto University)
Shao, Arick (University of Toronto)
Smith, Paul (University of California Berkeley)
Sverak, Vladimir (University of Minnesota)
Szeftel, Jeremie (Ecole Normal Superieure)
Tataru, Daniel (University of California, Berkeley)
Titi, Edriss (University of California)
Tsai, Tai-Peng (University of British Columbia)
Wang, Shuxia (Peking University)
Zhang, Xiaoyi (University of Iowa)
Zwiers, Ian (University of British Columbia)

Model Reduction in Continuum Thermodynamics: Modeling, Analysis and Computation September 16-21, 2012

Organizers:

Eduard Feireisl (Academy of Sciences of the Czech Republic)

Josef Málek (Charles University)

Model reduction represents an important topic, which is attracting growing attention of both the mathematical community and specialists interested in applications. The workshop focussed on the following leading topics: Mathematical theory of compressible and incompressible viscous fluids, singular limits with applications in fluid mechanics, scale analysis and numerical implementations, and mathematical modelling of complete fluid systems. Each topic was introduced to participants by means of a key note lecture delivered by a leading expert in the field followed by other participants contributions, active exchange of ideas, and informal discussion. The meeting brought together experts that would probably never meet at other occasions given the diversity of their respective fields.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5029

Participants:

Březina, Jan (Kyushu University)
Bulíček, Miroslav (Charles University)
Feireisl, Eduard (Academy of Sciences of the Czech Republic)
Gander, Martin (University of Geneva)
Gwiazda, Piotr (University of Warsaw)
Heida, Martin (Technical University of Dortmund)
Hron, Jaroslav (Charles University)
Ibragimov, Akif (Texas Technical University)
Jiang, Song (Institute of Applied Physics and Computational Mathematics)
Klein, Rupert (Freie Universität Berlin)
Kreml, Ondřej (Institute of Mathematics of the Academy of Sciences of the Czech Republic)
Málek, Josef (Charles University)
Minakowski, Piotr (University of Warsaw)
Mucha, Piotr (University of Warsaw)
Nečasová, Šárka (Institute of Mathematics of the Academy of Sciences)
Neustupa, Jiří (Institute of Mathematics of the Academy of Sciences)
Novotný, Antonín (Université du Sud Toulon-Var)
Pokorný, Milan (Charles University)
Rajagopal, Kumbakonam (Texas A & M)
Silvester, David (University of Manchester)
Šrámek, Ondřej (University of Maryland)
Steinhauer, Mark (University Koblenz-Landau, Campus Koblenz, Fachbereich 3)
Strakoš, Zdeněk (Charles University in Prague)
Świerczewska-Gwiazda, Agnieszka (University of Warsaw)
Vasseur, Alexis (University of Texas at Austin)
Vohralík, Martin (Université Pierre et Marie Curie)

Integrable Systems, Growth Processes and KPZ Universality
September 23-28, 2012

Organizers:

Estelle Basor (American Institute of Mathematics)
John Harnad (Centre de recherches mathematiques, Universite de Montreal, and Concordia University)
Jeremy Quastel (University of Toronto)
Timo Seppalainen (University of Wisconsin)
Craig Tracy (University of California, Davis)

This workshop brought together various experts in integrable systems, interacting particle systems, and stochastic PDEs to allow the cross fertilization that is necessary to go to the next level of universality theorems. The recent work of Amir, Corwin and Quastel, and Sasamoto and Spohn have established a rigorous theory of the stochastic PDE called the KPZ equation. Their starting point is an exact formula by Tracy and Widom for the distribution of the particle position in the asymmetric simple exclusion process (ASEP). Extending these results to other initial conditions as well as the more difficult problem of general exclusion processes (not necessarily nearest neighbor) is currently an open problem. Recent experimental work by Takeuchi and Sano have established that these processes occur in nature (see their recent Physical Review Letter).
A second aspect, and one that was celebrated in the evenings, was the 80th birthday of Harold Widom (born September 23, 1932). Widom's work is at the core of many of these recent advancements.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5015

Participants:

Adler, Mark (Brandeis University)
Baik, Jinho (University of Michigan)
Basor, Estelle (American Institute of Mathematics)
Bertola, Marco (Concordia University)
Bleher, Pavel (Indiana University - Purdue University at Indianapolis)
Bloemendal, Alex (Harvard University)
Borodin, Alexei (MIT)
Chen, Yang (University of Macau)
Chhita, Sunil (KTH)
Corwin, Ivan (MIT)
Ehrhardt, Torsten (UC Santa Cruz)
Götze, Friedrich (University of Bielefeld)
Harnad, John (Centre de recherches mathematiques, Universite de Montreal, and Concordia University)
Its, Alexander (Indiana University - Purdue University Indianapolis)
Johansson, Kurt (KTH Royal Institute of Technology)
Johnstone, Iain (Stanford University)
McLaughlin, Ken (University of Arizona)
Mulase, Motohico (University of California, Davis)
Nordenstam, Eric (University of Vienna)
O'Connell, Neil (University of Warwick)
Orlov, Alexander (Russian Academy of Sciences)
Ortmann, Janosch (University of Toronto)
Quastel, Jeremy (University of Toronto)
Rains, Eric (Caltech, Mathematics Department)
Rider, Brian (University of Colorado at Boulder)
Romik, Dan (Univeristy of California Davis)
Sasamoto, Tomohiro (Chiba University)
Schehr, Gregory (laboratoire de physique théorique et modèles statistiques LPTMS)
Seppalainen, Timo (University of Wisconsin)
Shinault, Gregory (University of Wisconsin)
Soshnikov, Alexander (University of California, Davis)
Spohn, Herbert (Technische Universität München)
Takeuchi, Kazumasa (University of Tokyo)
Tracy, Craig (University of California, Davis)
Valkó, Benedek (University of Wisconsin - Madison)
Van Moerbeke, Pierre (Universite de Louvain)
Virág, Bálint (University of Toronto)
Widom, Harold (University of California Santa Cruz)

Lie Algebras, Torsors and Cohomological Invariants
September 30-October 5, 2012

Organizers:

Stefan Gille (University of Alberta)
Nikita Karpenko (UPMC Sorbonne Universités)
Arturo Pianzola (University of Alberta)
Vera Serganova (UC Berkeley)
Kirill Zainoulline (University of Ottawa)

The theory of Lie algebras and the theory of torsors are well-established areas of modern mathematics. The first deals with the study and classification of (in-)finite dimensional Lie algebras and has many applications in representation theory, combinatorics and mathematical physics. The second studies and classifies so-called twisted forms of algebraic objects and has many applications in algebraic geometry and number theory. The bridge between Lie algebras and torsors is provided by various cohomological invariants. This interdisciplinary activity brought together specialists and young researchers to establish new links and projects and to advertise these research areas.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5008

Participants:

Baek, Sanghoon (KAIST)
Bayer-Fluckiger, Eva (Ecole Polytechnique Federale de Lausanne)
Calmes, Baptiste (Université d'Artois)
Cernele, Shane (University of British Columbia)
Chang, Zhihua (University of Alberta)
Chernousov, Vladimir (University of Alberta)
De Clercq, Charles (Universite Paris 6)
Derenthal, Ulrich (LMU Muenchen)
Dimitrov, Ivan (Queen's University)
Duncan, Alexander (University of Michigan, Ann Arbor)
Florence, Mathieu (Université Paris 6)
Garibaldi, Skip (Emory University)
Gille, Stefan (University of Alberta)
Gille, Philippe (Ecole Normale Superieure)
Haution, Olivier (University of Nottingham/LMU Munich)
Hoffmann, Detlev (TU Dortmund)
Karpenko, Nikita (UPMC Sorbonne Universités)
Kiritchenko, Valentina (Higher School of Economics)
Knus, Max (ETH Zurich)
Krashen, Daniel (University of Georgia)
Kuttler, Jochen (University of Alberta)
Lau, Michael (Universite Laval)
Lemire, Nicole (University of Western Ontario)
Loetscher, Roland (LMU Munich)
Mathieu, Olivier (Universite Lyon 1)
Merkurjev, Alexander (UCLA)
Minác, Ján (University of Western Ontario)
Neher, Erhard (University of Ottawa)
Parimala, Raman (Emory University)
Pianzola, Arturo (University of Alberta)
Pirutka, Alena (IRMA Strasbourg)
Popov, Vladimir (Steklov Mathematical Institute, Russian Academy of Sciences)
Queguiner-Mathieu, Anne (Université Paris 13)
Remy, Bertrand (University of Lyon)
Saltman, David J (Center for Communications Research - Princeton)
Semenov, Nikita (Mainz University)
Serganova, Vera (UC Berkeley)
Tignol, Jean-Pierre (Université Catholique de Louvain)
Vishik, Alexander (University of Nottingham)
Yahorau, Uladzimir (University of Alberta)
Zainoulline, Kirill (University of Ottawa)
Zhykhovich, Maksim (Universite Paris 6)

Graph Searching
October 7-12, 2012

Organizers:

Fedor Fomin (University of Bergen)
Richard Nowakowski (Dalhousie University)
Pawel Pralat (Ryerson University)
Dimitrios Thilikos (National and Kapodistrian University of Athens)

There are many variants of graph searching studied in the literature, which are either application driven, i.e. motivated by problems in practice, or are inspired by foundational issues in Computer Science, Discrete Mathematics, and Artificial intelligence, including: Information Seeking, Robot motion planning, Graph Theory, Database Theory and Robber and Marshals Games, Logic, Distributed Computing, Models of computation, and Network security. A major focus of this workshop was set on graph searching problems and large scale networks, including tutorial in some of the successful methods. The workshop brought together researchers in Graph Searching and those versed in the analysis of large scale networks. For some historical reasons, Canada is the stronghold of both fields, with several groups and individuals spread around the country.

In the past three years, problems emerged from real applications related to the structure of modern (or projected) networks that are expected to be large scale and dynamic, and where agents' behaviour can be probabilistic, decentralized and even selfish and antagonistic.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5055

Participants:

Bonato, Anthony (Ryerson University)
Clarke, Nancy (Acadia University)
Dereniowski, Dariusz (Gdansk University of Technology)
Diaz, Josep (Universitat Politecnica de Catalunya)
Dudek, Andrzej (Western Michigan University)
Dyer, Danny (Memorial University)
Erickson, Lawrence (UIUC)
Finbow, Stephen (St. Francis Xavier University)
Fitzpatrick, Shannon (University of Prince Edward Island)
Gavenciak, Tomas (Charles University)
Gordinowicz, Przemyslaw (Technical University of Lodz)
Hahn, Gena (University of Montreal)
Kinnersley, Bill (UIUC)
Kratochvil, Jan (Charles University)
Messinger, Margaret-Ellen (Mount Allison University)
Müller, Tobias (Utrecht University)
Nisse, Nicolas (INRIA Sophia Antipolis)
Nowakowski, Richard (Dalhousie University)
Pardo Soares, Ronan (I3S-CNRS/INRIA/UNS)
Pralat, Pawel (Ryerson University)
Seamone, Ben (Université de Montréal)
Stacho, Ladislav (Simon Fraser University)
Thilikos, Dimitrios (National and Kapodistrian University of Athens)
West, Douglas (UIUC)
Widmayer, Peter (ETH)
Yang, Boting (University of Regina)

Topological Data Analysis and Machine Learning Theory
October 14-19, 2012

Organizers:

Gunnar Carlsson (Stanford University)
Dmitry Feichtner-Kozlov (Bremen University)
Rick Jardine (University of Western Ontario)
Dmitriy Morozov (Lawrence Berkeley National Laboratory)

While the fields address closely related questions, it is not yet common for the researchers from the different disciplines to meet: there are no regular joint conferences. This meeting created a clear mutual benefit for researchers in both fields. Machine learning techniques have employed geometry and topology, and, therefore, continues to benefit from the latest developments. Topologists, in turn, have gained from learning about the current state of the art in machine learning, and thus, better aligned their work with the current developments in the parallel field. This meeting platform created an opportunity for the different groups to gather and identified shared interests, complementary challenges, and promising areas of collaboration.

In the last two decades, the dropping cost of acquisition and the sharing ease of the raw data have created a demand for the analysis of its ever-increasing volumes. Examples of situations where this occurs range from protein docking to social networks. Statistics and machine learning have traditionally supplied methods for such analysis.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5081

Participants:

Angell, Jeffrey (Johns Hopkins University Applied Physics Laboratory)
Attali, Dominique (CNRS, Grenoble)
Bak, Anthony (Stanford University)
Bauer, Kristine (University of Calgary)
Belkin, Mikhail (Ohio State University)
Bendich, Paul (Duke University)
Bubenik, Peter (Cleveland State University)
Carlsson, Gunnar (Stanford University)
Chazal, Frederic (INRIA Saclay Ile-de-France)
Chin, Peter (Johns Hopkins University)
de Silva, Vin (Pomona College)
Denham, Graham (University of Western Ontario)
Fasy, Brittany Terese (Carnegie Mellon University)
Feichtner-Kozlov, Dmitry (Bremen University)
Harer, John L. (Duke University)
Jardine, Rick (University of Western Ontario)
Johnson, Jesse (Oklahoma State University)
Kaczynski, Tomasz (Université de Sherbrooke)
Kahle, Matthew (Ohio State University)
Lerman, Gilad (University of Minnesota)
Memoli, Facundo (The University of Adelaide)
Merigot, Quentin (Université de Grenoble / CNRS)
Mischaikow , Konstantin (Rutgers University)
Morozov, Dmitriy (Lawrence Berkeley National Laboratory)
Mukherjee, Sayan (Duke University)
Müllner, Daniel (Stanford University)
Nicolau, Monica (Stanford University)
Patel, Amit (Rutgers University)
Peters, Thomas (University of Connecticut)
Raussen, Martin (Aalborg University)
Schuetz, Dirk (Durham University)
Sheehy, Don (INRIA Saclay Ile-de-France)
Wang, Yusu (Ohio State University)

Recent Advances in Transversal and Helly-type Theorems in Geometry, Combinatorics and Topology
October 21-26, 2012

Organizers:

Imre Barany (Renyi Institute)
Ted Bisztriczky (University of Calgary)
Luis Montejano (National University of Mexico)
Deborah Oliveros (UNAM)
Richard Pollack (Courant Institute of Mathematics)

A point, a line, a plane, or its generalization in higher dimensions, a hyperplane, is called a transversal to a family of sets if it intersects every member of a family. In 1913, Eduard Helly proved one of the most celebrated results in geometry that gives conditions for the members of a family of convex objects (with convex boundary and without holes) to have a common point. Helly's theorem gives rise to numerous generalizations and variants, many of which focus on conditions for families of objects to have a common transversal. This workshop assembled the key people working in this area in order to explore recent progress and to help focus on future directions of research in geometric transversal theory.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5020

Participants:

Aronov, Boris (Polytechnic Institute of New York University)
Bisztriczky, Ted (University of Calgary)
Böröczky, Károly (Eötvös Loránd University)
Bracho, Javier (UNAM)
Cheong, Otfried (KAIST)
Deza, Antoine (McMaster University)
Eckhoff, Jürgen (Technische Universität Dortmund)
Fodor, Ferenc (University of Szeged)
Garcia Colin, Natalia (UNAM)
Goaoc, Xavier (INRIA)
Heppes, Aladar (Renyi Institute)
Holmsen, Andreas (KAIST)
Hubard, Alfredo (École Normale Superieure)
Karasev, Roman (Yaroslavl' State University)
Kuperberg, Wlodzimierz (Auburn University)
Montejano, Luis (National University of Mexico)
Oliveros, Deborah (UNAM)
Patiño Cárdenas, Teresa (Centro de Ciencias Matemáticas UNAM, Campus Morelia)
Pollack, Richard (Courant Institute of Mathematics)
Raggi Perez, Miguel (UNAM)
Ramirez Alfonsin, Jorge (Université Montpellier 2)
Roldán-Pensado, Edgardo (University College London)
Schaer, Jonathan (University of Calgary)
Schneider, Rolf (University of Freiburg)
Soberón, Pablo (University College London)
Sottile, Frank (Texas A & M University)
Strausz, Ricardo (Universidad Nacional Autonoma de Mexico)
Toth, Csaba (University of Calgary)
Trelford, Ryan (University of Calgary)
Tverberg, Helge (University of Bergen)

New Trends in Noncommutative Algebra and Algebraic Geometry
October 28-November 2, 2012

Organizers:

Michael Artin (MIT)
Jason Bell (Simon Fraser University)
Colin Ingalls (University of New Brunswick)
Lance Small (UC, San Diego)
James Zhang (University of Washington)

This workshop provided a useful follow-up to the 5-day BIRS workshop "Interactions Between Noncommutative Algebra and Algebraic Geometry" from October 26-31, 2008; the 5-day Manchester workshop on "Noncommutative algebraic geometry'', the University of Manchester, UK, from August 3-8, 2009; and the RIMS workshop on "Noncommutative Algebraic Geometry and Related Topics'', the University of Kyoto, Japan, from August 24-28, 2009. The main theme of this workshop was the interplay between noncommutative algebra and algebraic geometry. This workshop brought together researchers who use geometric and/or homological methods in different areas of noncommutative algebra (including representation theory of algebras) and algebraic geometers who have an interest in non-commutative phenomena, in order to encourage their interaction and collaboration.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5049

Participants:

Andruskiewitsch, Nicolás (UNC)
Bell, Jason (Simon Fraser University)
Bocklandt, Raf (Newcastle University)
Brown, Ken (University of Glasgow)
Brzezinski, Tomasz (Swansea University)
Casteels, Karel (UC, Santa Barbara)
Chan, Daniel (Univesity of New South Wales)
Chan, Kenneth (University of Washington)
Goodearl, Kenneth (UC, Santa Barbara)
Guangbin Zhuang, Guangbin (University of Washington)
Huisgen-Zimmermann, Birge (UC, Santa Barbara)
Ingalls, Colin (University of New Brunswick)
Kirkman, Ellen (Wake Forest University)
Krähmer, Ulrich (University of Glasgow)
Kulkarni, Rajesh (Michigan State University)
Launois, Stéphane (University of Kent)
Leuschke, Graham (Syracuse University)
Lorenz, Martin (Temple University)
Montgomery, Susan (USC)
Negron, Cris (University of Washington)
Rogalski, Daniel (UC, San Diego)
Rowen, Louis (Bar Ilan University)
Saltman, David J (Center for Communications Research - Princeton)
Sierra, Susan (University of Edinburgh)
Sisodia, Gautam (University of Washington)
Small, Lance (University of California, San Diego)
Smith, Paul (University of Washington)
Stafford, J. Toby (University of Manchester)
Vancliff, Michaela (University of Texas at Arlington)
Vonessen, Nikolaus (University of Montana)
Walton, Chelsea (University of Washington)
Wang, Xingting (University of Washington)
Wang, Linhong (Southeastern Louisiana University)
Witherspoon, Sarah (Texas A & M)
Wu, Quanshui (Fudan University)
Yakimov, Milen (Louisiana State University)
Yekutieli, Amnon (Ben Gurion University)
Zhang, James (University of Washington)

Spectral Analysis, Stability and Bifurcation in Modern Nonlinear Physical Systems
November 4-9, 2012

Organizers:

Paul Binding (University of Calgary)
Thomas Bridges (University of Surrey)
Yasuhide Fukumoto (Kyushu University)
Igor Hoveijn (Noordelijke Hogeschool Leeuwarden)
Oleg Kirillov (Helmholtz-Zentrum Dresden-Rossendorf)
Dmitry Pelinovsky (McMaster University)

This workshop brought together specialists in the theory of Pontryagin and Krein spaces, analysis of PDEs, singularity theory and dynamical systems, numerical analysis and applied linear algebra as well as mathematical and theoretical physicists to understand hidden new intriguing connections between stability issues in nonlinear partial differential equations, geometrical optics stability analysis and dissipation-induced instabilities, as well as to unify existing approaches to linearised stability analysis of stationary and periodic solutions of both finite and infinite dimensional dynamical systems. These different topics were connected together in a sequence of original talks and a number of research collaborations in six focus groups.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5073

Participants:

Behrndt, Jussi (TU Graz)
Berry, Michael (H. H. Wills Physics Laboratory)
Bigoni, Davide (University of Trento)
Buono, Luciano (University of Ontario Institute of Technology)
Burchard, Almut (University of Toronto)
Chorianopoulos, Christos (University of Calgary)
Chugunova, Marina (Claremont Graduate University)
Cushman, Richard (University of Calgary)
Derks, Gianne (University of Surrey)
Doaré, Olivier (ENSTA-Paristech)
Dobrokhotov, Sergey (A.Ishlinski Institute for Problem in Mechanics of RAS)
Efstathiou, Konstantinos (University of Groningen)
Fujiié, Setsuro (Ritsumeikan University)
Fukumoto, Yasuhide (Kyushu University)
Hagstrom, George (Courant Institute)
Hirota, Makoto (Japan Atomic Energy Agency)
Kevrekidis, Panayotis (UMass)
Kirillov, Oleg (Helmholtz-Zentrum Dresden-Rossendorf)
Knobloch, Edgar (University of California Berkeley)
Kollar, Richard (Comenius University)
Lamb, Jeroen (Imperial College London)
Lancaster, Peter (University of Calgary)
Langford, William (University of Guelph)
Le Dizes, Stephane (CNRS - Aix-Marseille University)
Llewellyn Smith, Stefan (UC, San Diego)
Luzzatto-Fegiz, Paolo (Woods Hole Oceanographic Institution)
Maddocks, John (Ecole Polytechnique Federale de Lausanne)
Makrides, Elizabeth (Brown University)
Maslowe, Sherwin (McGill University)
Morrison, Philip (University of Texas at Austin)
Nier, Francis (Université de Rennes)
Oliveras, Katie (Seattle University)
Overton, Michael (New York University)
Pelinovsky, Dmitry (McMaster University)
Tassi, Emanuele (CNRS - Centre de Physique Theorique de Marseille)
Trunk, Carsten (TU Ilmenau)
Williamson, Charles (Cornell University)
Yoshida, Zensho (University of Tokyo)

Nonequilibrium Statistical Mechanics: Mathematical Understanding and Numerical Simulation
November 11-16, 2012

Organizers:

Joel Lebowitz (Rutgers University)
Stefano Olla (Université Paris Dauphine)
Gabriel Stoltz (École des Ponts, CERMICS)

The workshop aimed at gathering a mixed audience, composed of mathematicians, physicists and computer scientists, studying nonequilibrium systems from a theoretical wiewpoint or through numerical simulations. There is a strong interplay between theoretical considerations (which may trigger numerical validations or extensions), and numerical simulations (it is often the case that some ad-hoc dynamics invented for a given application turns out to be of much broader interest; also, numerical experiments may motivate new theoretical results or investigations). This workshop aimed to motivate more work on the mathematical understanding of simulation methods, for instance, by suggesting some appropriate importance sampling or variance reduction methods for nonequilibrium dynamics.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5013

Participants:

Bernardin, Cédric (Ecole Normale Superieure de Lyon)
Bonetto, Federico (Georgia Institute of Technology)
De Roeck, Wojciech (Universitat Heidelberg)
Dhar, Abhishek (Raman Research Institute)
Evans, Martin (University of Edinburgh)
Greenblatt, Rafael (Université Paris Descartes)
Hartmann, Carsten (Freie Universität Berlin)
Huveneers, Francois (Universite de Paris Dauphine)
Iacobucci, Alessandra (Universite Paris Dauphine)
Jaksic, Vojkan (McGill University)
Jara, Milton (IMPA)
Joubaud, Rémi (Imperial College)
Kim, Chanwoo (University of Cambridge)
Korepanov, Alexey (University of Alabama at Birmingham)
Lebowitz, Joel (Rutgers University)
Legoll, Frédéric (Ecole Nationale des Ponts et Chaussees LAMI)
Lelièvre, Tony (École des Ponts ParisTech)
Lepri, Stefano (Istituto dei Sistemi Complessi)
Letizia, Viviana (Universite de Paris Dauphine)
Liverani, Carlangelo (University of Rome Tor Vergata)
Livi, Roberto (Universita di Firenze)
Lukkarinen, Jani (University of Helsinki)
Maes, Christian (University of Leuven)
Morriss, Gary (University of New South Wales)
Mukamel, David (Weizmann Institute)
Olla, Stefano (CEREMADE - Université Paris Dauphine)
Pantazis, Yannis (University of Massachusetts)
Pillet, Claude-Alain (Universite du Sud Toulon-Var)
Rousset, Mathias (INRIA Lille)
Sanders, David P. (Universidad Nacional Autónoma de México)
Sasada, Makiko (Keio University)
Simon, Marielle (Ecole Normale Superieure de Lyon)
Spohn, Herbert (Technische Universität München)
Stoltz, Gabriel (École des Ponts, CERMICS)
Zimmer, Johannes (University of Bath)

First Nations Math Education
November 18-23, 2012

Organizers:

Melania Alvarez (BC Education Coordinator)
Genevieve Fox (Fox Consulting)
Sharon Friesen (University of Calgary)
Cynthia Nicol (University of British Columbia)

A group of Elders, mathematicians, math educators, and teachers have come together to find ways to improve mathematics education among aboriginals while at the same time, acknowledging the importance of traditional culture. The main goal of this meeting was to create resources that are sound, interesting and challenging mathematically, with a factual and rich cultural context, so that they can be provided to various venues of instruction in order to supply a more balanced curriculum where aboriginal culture can take its rightful place. Presently only 2% of BC's Aboriginal population completes Principles of Mathematics (POM) 12 compared to a completion rate of 25% for the whole BC population. This discrepancy in completion rate was one of the issues this group addressed, given that successful completion of POM 12 is a compulsory entrance prerequisite for many post-secondary programs in British Columbia, and the statistics are similar in the other provinces.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5076

Participants:

Alphonse, Shirley (Elder)
Alvarez, Melania (BC Education Coordinator)
BruisedHead, Annette (Kainai High School)
Desaulniers, Shawn (Okanagan College)
Doolittle, Edward (First Nations University of Canada)
Erickson, Alejandro (University of Victoria)
Forrest, Brian (University of Waterloo)
Forrest, Barb (University of Waterloo)
Fox, Genevieve (Fox Consulting)
Fox, Amanda (Kainai High School)
Guy, Richard (University of Calgary)
Hanoski, Kaleena (Quinte Mohawk School)
Healy, Trina (Red Crow College)
Jungic, Veselin (Simon Fraser University)
King-Hunt, Kathleen (SD62)
Lagu, Indy (Mount Royal University)
Langevin, Karla (Kainai High School)
Leeming, David (University of Victoria)
MacLean, Mark (University of British Columbia)
McDonnell, Theresa (Calgary Board of Education)
Megginson, Robert (University of Michigan)
Petrie, Linda (Blue Quills)
Preciado Babb, Armando Paulino (University of Calgary)
Redbear, Gerry (Yellowhead Tribal College Elder)
Roy, Simon (None)
Russell, Caroline (Tatsikiisaapo'p Middle School)
Scout-Bastien, Kathy (Piikani Blackfoot reserve)
Seymour, Loretta (First Nations Math Education)
Seymour, Colleen (Sk'elep School of Excellence)
Seymour, Dorinne (Elder)
Sibley, Garry (Federation of Saskatchewan Indian Nations)
Sterenberg, Gladys (University of Alberta)
Tailfeathers, Ruby (Kainai High School)
Verreault, Jocelyn (Yellowhead Tribal College)
Water Chief, Natasha (Siksika Board of Education)
Weston, Harley (University of Regina)

Cohomological Methods in Geometric Group Theory
November 25-30, 2012

Organizers:

Benson Farb (University of Chicago)
Dave Morris (University of Lethbridge)
Graham Niblo (University of Southampton)
Karen Vogtmann (Cornell University)

This workshop brought together experts from three areas of mathematics in which cohomological methods have recently played a fundamental role: geometric group theory, non-commutative geometry and coarse geometry. Principle topics discussed include: (i) representation stability, as introduced by Church and Farb in order to expand the important and well-studied concept of homological stability to a far broader context;
(ii) the proof of the Borel, and Farrell-Jones conjectures by Lueck and Bartels for hyperbolic groups and CAT(0) groups; and (iii) bounded cohomology, amenability and generalisations, motivated by the recent work of Burger-Iozzi-Wienhard, Monod, Calegari and others illustrating their power to solve problems in diverse areas, including rigidity, orbit equivalence and amenability.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5080

Participants:

Bartels, Arthur (Universität Münster)
Berglund, Alexander (University of Copenhagen)
Brodzki, Jacek (University of Southampton)
Bucher, Michelle (Université de Genève)
Burger, Marc (ETH Zurich)
Bux, Kai Uwe (Bielefeld University)
Capraro, Valerio (University of Southampton)
Church, Thomas (Stanford University)
Cohen, David (Rice University)
Davis, Michael (Ohio State University)
Farb, Benson (University of Chicago)
Fujiwara, Koji (Kyoto University)
Grigoriev, Ilya (Stanford University)
Hatcher, Allen (Cornell University)
Iozzi, Alessandra (ETH Zurich)
Kar, Aditi (University of Oxford)
Kropholler, Peter (University of Glasgow)
Leary, Ian (University of Southampton)
Lück, Wolfgang (University at Bonn)
Mineyev, Igor (UIUC)
Morris, Dave (University of Lethbridge)
Niblo, Graham (University of Southampton)
Nowak, Piotr (University of Warsaw)
Nucinkis, Brita (Southampton)
Papadopulos, Patrick (University of Rochester)
Putman, Andrew (Rice University)
Reich, Holger (Freie Universität Berlin)
Rosenthal, David (St. Johns University)
Sakasai, Takuya (The University of Tokyo)
Sauer, Roman (Karlsruhe Institute of Technology)
Schick, Thomas (Georg-August-Universität Göttingen)
Suzuki, Masaaki (Akita University)
Tshishiku, Bena (University of Chicago)
Vogtmann, Karen (Cornell University)
Wahl, Nathalie (University of Copenhagen)
Wilson, Jennifer (The University of Chicago)
Wortman, Kevin (University of Utah)
Wright, Nick (University of Southampton)

String Theory and Generalized Geometries
December 2-7, 2012

Organizers:

Katrin Becker (Texas A & M)
Melanie Becker (Texas A & M)
David Morrison (UC, Santa Barbara)
Daniel Robbins (University of Amsterdam)
Shing-Tung Yau (Harvard University)

This workshop brought together experts from around the world, both mathematicians and physicists, in order to study some of the new classes of string theory solutions and advance both the physical and mathematical understanding of them and the connections between them. The workshop focused primarily on the introduction of fluxes, both for heterotic and type II string theory, and on the dualities between different solutions. Mathematically, these spaces should have descriptions in terms of generalized geometries, perhaps with extra structures (bundles or sheafs).The objectives of the workshop related to two somewhat broad directions:
(i) Related the effective physical description of these string theory solutions to the mathematical structures of the corresponding spaces and (ii) identified the web of physical equivalences between different classes of examples and understood how those equivalences are realized on the mathematical structures involved.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5098

Participants:

Adams, Allan (MIT)
Anguelova, Lilia (Perimeter Institute for Theoretical Physics)
Becker, Katrin (Texas A & M)
Becker, Melanie (Texas A & M)
Berman, David (Queen Mary, University of London)
Bouchard, Vincent (University of Alberta)
Candelas, Philip (University of Oxford)
Dasgupta, Keshav (McGill University)
Gualtieri, Marco (University of Toronto)
Halmagyi, Nick (Université Paris VI)
Katz, Sheldon (University of Illinois)
Lapan, Joshua (McGill)
McOrist, Jock (University of Surrey)
Melnikov, Ilarion (Max Planck Institute for Gravitational Physics (Albert Einstein Institute))
Mendez-Diez, Stefan (University of Alberta)
Minasian, Ruben (CEA Saclay)
Robbins, Daniel (University of Amsterdam)
Seo, Jihye (McGill University)
Sethi, Savdeep (University of Chicago)
Sharpe, Eric (Virginia Tech)
Taylor, Washington (MIT)
Tomasiello, Alessandro (Universita` di Milano-Bicocca)
Torres, Rafael (Oxford University)
Tseng, Li-Sheng (University of California Irvine)
Waldram, Daniel (Imperial College London)
Wissanji, Alisha (University of Alberta)

Thin Liquid Films and Fluid Interfaces: Models, Experiments and Applications December 9-14, 2012

Organizers:

Robert Behringer (Duke University)
Karen Daniels (North Carolina State University)
Rachel Levy (Harvey Mudd College)
Omar K. Matar (Imperial College London)
Michael Shearer (North Carolina State University)
Thomas Witelski (Duke University)

This multidisciplinary workshop focused on the recent developments in the mathematics of thin film flow, with connections to experiments and applications. The workshop brought together mathematicians, physicists, and engineers at the forefront of research in experiments, mathematical analysis, modeling, and computational fluid dynamics to work on areas of common interest including thin films and free surface flows, the dynamics of droplets, applications to biology and medicine, and industrial applications.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/5-day-workshops/12w5035

Participants:

Auernhammer, Günter K. (Max Planck Institute for Polymer Research)
Balmforth, Neil (University of British Columbia)
Behringer, Robert (Duke University)
Bostwick, Joshua (North Carolina State University)
Braun, Richard (University of Delaware)
Cabral, Joao (Imperial College London)
Chugunova, Marina (Claremont Graduate University)
Cummings, Linda (New Jersey Institute of Technology)
Daniels, Karen (North Carolina State University)
Davis, Steve (Northwestern University)
Dijksman, Joshua (Duke University)
Garoff, Stephen (Carnegie-Mellon University)
Herde, Daniel (Max Planck Institute for Dynamics and Self-Organisation)
Hewitt, Ian (University of British Columbia)
Hosoi, Anette (MIT)
Jacobs, Karin (Saarland University)
Khatri, Shilpa (University of North Carolina at Chapel Hill)
Kitavtsev, Georgy (Max Planck Institute of Mathematics in the Sciences)
Kondic, Lou (New Jersey Institute of Technology)
Krechetnikov, Rouslan (UC Santa Barbara)
Kumar, Satish (University of Minnesota)
Levy, Rachel (Harvey Mudd College)
Lister, John (University of Cambridge)
Maki, Kara (Rochester Institute of Technology)
Manor, Ofer (Royal Melbourne Institute of Technology)
Papageorgiou, Demetrios (Imperial College London)
Paterson, Colin (University of Strathclyde)
Persad, Aaron (University of Toronto)
Peschka, Dirk (Weierstrass Institute Berlin)
Seemann, Ralf (Saarland University)
Shearer, Michael (North Carolina State University)
Sibley, David (Imperial College London)
Smolka, Linda (Bucknell University)
Stokes, Yvonne (University of Adelaide)
Swanson, Ellen (Centre College)
Szulczewski, Michael (MIT)
Thiele, Uwe (University of Loughborough)
Tilley, Burt (Worcester Polytechnic Institute)
Ulusoy, Suleyman (Zirve University)
Wilson, Stephen (University of Strathclyde)
Witelski, Thomas (Duke University)

Banff International Research Station

2012

2-Day Workshops

North West Functional Analysis Seminar
March 30-April 1, 2012

Organizers:

Martin Argerami (University of Regina)
Marcelo Laca (University of Victoria)
Michael Lamoureux (University of Calgary)
Volker Runde (University of Alberta)

The Northwest Functional Analysis Seminar (NWFAS) is a bi-annual regional scientific meeting of researchers (faculty and postdoctoral) and graduate students in functional analysis. In 2012, participants were drawn from universities in Western Canada and the American Northwest. This meeting enabled researchers from a large geographical area to stay in touch with developments in the general field but outside their respective areas of specialization, and provided a forum for junior researchers (junior faculty, postdocs, and graduate students) to present their results to a wider audience and to form contacts with other functional analysts within the region. Most of the talks were delivered by junior researchers and there were a few presentations delivered by senior researchers on topics currently attracting high levels of interest.

The two-day workshop represented the fifth edition of the seminar, following very successful earlier meetings held in 2003, 2005, 2007 and 2009. In addition to presenting a strong scientific program, the workshop provided the only venue by which the region's researchers in functional analysis could come into contact regularly. The NWFAS also continues to play a formative role in developing the profiles of early-career researchers. This meeting included ten forty-minute talks, which allowed time for informal discussion.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2163

Participants:

Alonso, David (University of Alberta)
Alzulaibani, Alaa (University of Regina)
Argerami, Martin (University of Regina)
Bhattacharya, Angshuman (University of Regina)
Brenken, Berndt (University of Calgary)
Brudnyi, Alex (University of Calgary)
Choi, Yemon (University of Saskatchewan)
Emerson, Heath (University of Victoria)
Erlijman, Juliana (University of Regina)
Floricel, Remus (University of Regina)
Gao, Niushan (University of Alberta)
Georgescu, Magdalena (University of Victoria)
Gheorghiu, Vlad (University of Calgary)
Gour, Gilad (University of Calgary)
Guex, Sebastien (University of Alberta)
Høynes, Siri-Malen (Norwegian University of Science and Technology)
Julien, Antoine (University of Victoria)
Kinzebulatov, Damir (The Fields Institute)
Laca, Marcelo (University of Victoria)
Lamoureux, Michael (University of Calgary)
Lau, Anthony To-Ming (University of Alberta)
Mazowita, Matthew (University of Alberta)
Phillips, John (University of Victoria)
Poulin, Denis (University of Alberta)
Prochno, Joscha (University of Alberta)
Putnam, Ian (University of Victoria)
Rivasplata, Omar (University of Alberta)
Runde, Volker (University of Alberta)
Samei, Ebrahim (University of Saskatchewan)
Sourour, Ahmed Ramzi (University of Victoria)
Spektor, Susanna (University of Alberta)
Tahmasebi, Nazanin (University of Alberta)
Troitsky, Vladimir (University of Alberta)
Viselter, Ami (University of Alberta)
Zabeti, Omid (University of Alberta)

Ted Lewis Workshop on SNAP Math Fairs in 2012
April 27-29, 2012

Organizers:

Tiina Hohn (Grant MacEwan University)
Ted Lewis (SNAP mathematics foundation)
Andy Liu (University of Alberta)

This was the ninth annual math fair workshop at BIRS. The workshop was extremely popular with teachers in elementary and secondary schools, as it provided them with resources for their lessonplans, and helped to re-shape the way mathematics is being approached in the schools. Problem solving and puzzles in the classroom is now a specific area of the new curriculum and in service, teachers have had very little training in using these tools effectively. This was not limited to Alberta Schools and the snap math fair idea have now been spreading around the world. This type of 2 day workshop was considered front line approach in the collaborative effort between mathematicians, more experienced teachers, and all teachers interested in professional development to improve the mathematics teaching in the elementary level and beyond.To have teachers share their valuable experiences with math fair in their own schools would be the best and most usefull information to others.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2168

Participants:

Beltaos, Elaine (Grant MacEwan University)
Beltaos, Lillian (Teslacentral Enterprises)
Desaulniers, Shawn (Okanagan College)
Finn, Carleen (University of Alberta)
Francis-Poscente, Krista (University of Calgary)
Graves, Sean (University of Alberta)
Hoffman, Janice (Edmonton Public Schools)
Hohn, Tiina (Grant MacEwan University)
Jones, Carolyn (Dr.Donald Massey School)
Laporte, Cathy (Edmonton Catholic School Division)
Lewis, Ted (SNAP mathematics foundation)
Liu, Andy (University of Alberta)
Morrill, Ryan (University of Alberta)
Pasanen, Trevor (University of Alberta)
Taylor, Carla (St.Edmund School)
Thompson, Tanya (ThinkFun, Inc)

Workshop on Robust Optimization
May 25-27, 2012

Organizers:

Zhaosong Lu (Simon Fraser University) **Yuriy Zinchenko** (University of Calgary)

Firstly, this workshop gave a guided overview of the most recent developments in robust optimization, including modeling techniques, computational challenges, methods, and various robust optimization applications. This was achieved by bringing together a group of leading researchers in the field in a format of an intense and focused research oriented workshop. Presently, the field of robust optimization is too novel to offer a large stand-alone conference on the subject; thus a shorter workshop-type event appeared to be much better suited.

This important workshop was held in a timely manner, as nowadays, risk has become a considerable concern in many practical applications of optimization, (e.g., in finance), and many practitioners need to be better educated about the modeling and algorithmic capabilities of this newly emerging field. The second educational outreach objective was partially achieved by inviting more practitioners to participate in the event and by dissipating workshop slides through electronic media – a mechanism already provided by the Banff International Research Station.

Moreover, this workshop exposed its participants to recent developments and new challenges in the area, and thus helped to advance further research and better decision making in practice. By bringing together both the researchers in the area and practitioners, this meeting identified a set of strategic directions for the development of the field, which was driven by both the theory and practical needs.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2154

Participants:

Bandi, Chaitanya (MIT)
Behjat, Laleh (University of Calgary)
Bertsimas, Dimitris (MIT)
Caramanis, Constantine (U. Texas at Austin)
Chen, Michael (York University)
Delage, Erick (HEC Montréal)
Epelman, Marina (University of Michigan)
Goyal, Vineet (Columbia University)
Hauser, Raphael (University of Oxford)
Iancu, Dan (Stanford University)
Lee, Jon (University of Michigan)
Li, Jonathan (University of Toronto)
Lu, Zhaosong (Simon Fraser University)
Nematollahi, Eissa (University of Calgary)
Parrilo, Pablo (MIT)
Seck, Babacar (University of Calgary)
Shirvani Ghomi, Pooyan (University of Calgary)
Terlaky, Tamas (Lehigh University)
Trichakis, Nikolaos (Harvard Business School)
Tuncel, Levent (University of Waterloo)
Wild, Stefan (Argonne National Laboratory)
Zarepisheh, Masoud (UCSD)
Zinchenko, Yuriy (University of Calgary)

Differential Schemes and Differential Cohomology
June 22-24, 2012

Organizers:

Richard Churchill (CUNY and University of Calgary) **Yang Zhang** (The University of Manitoba)

The first objective of the workshop was to introduce very recent work on the “modernization” of differential algebra to algebraic geometers/number theorists having little or no acquaintance with the field. The basic properties of the differential spectrum (“DiffSpec”) of a differential ring have now been established in a manner which workers in those areas can quickly grasp, but those ideas need a proper venue for communication.

The second objective was to illustrate how algebraic problems, which can be solved ‘‘locally’’ in terms of differential equations, may admit global solutions in terms of differential cohomology. Specifically, very recent work by Ray Hoobler enabled one to understand Kolchin’s constrained cohomology in terms of the Delta-flat topology, and that should offer new methods to algebraic geometers and number theorists. And of course, the interaction of people in those areas with differential algebraists should result to new methods for use by the latter group.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2151

Participants:

Arreche, Carlos (CUNY)
Bauer, Mark (University of Calgary)
Chipalkatti, Japdeep (University of Manitoba)
Churchill, Richard (CUNY and University of Calgary)
Cockett, Robin (University of Calgary)
Freitag, Jim (UIC)
Gillet, Henri (UIC)
Hoobler, Ray (CUNY)
Jardine, Rick (University of Western Ontario)
Juan, Lourdes (Texas Tech University)
Keigher, William (Rutgers-Newark)
Magid, Andy (University of Oklahoma)
Padmanabhan, R. (University of Manitoba)
Sanabria, Camilo (Universidad de los Andes)
Scheidler, Renate (University of Calgary)
Sit, William (City University of New York)
Sun, Yao (Academy of Mathematics & System Science)
Wang, Dingkang (Acad Math/Sys)
Wechter, Matt (UIC)
Zhang, Yang (The University of Manitoba)

Women's Workshop on Communications and Signal Processing
July 13-15, 2012

Organizers:

Sheila Hemami (Cornell University)
Urbashi Mitra (University of Southern California)
Milica Stojanovic (Northeastern University)
Sarah Kate Wilson (Santa Clara University)

Women are significantly underrepresented in most engineering disciplines, with even fewer women in visible senior leadership roles, (e.g., full and chaired professors, Editors-in-Chief, Distinguished Lecturers, and members of the Board-of-Governors of their professional society). Although the number of women in these positions has, with concerted effort, been growing, it is still too small. This women workshop on Communications and Signal Processing have helped to attain the following goals:
(1) Highlighted the growing number of successful women in communications and signal processing
(2) Established a venue where younger women can interact with women role models who can become mentors and future references for IEEE Fellow and other distinguished awards
(3) Provided a place to learn how to achieve professional goals from women who have been there.
(4) Spotlighted the excellence in research achieved by women at all stages of their careers.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2147

Participants:

Ahmadian, Zahra (University of British Columbia)
Aissa, Sonia (INRS, Universite du Quebec)
Arianpoo, Nasim (University of British Columbia)
Chen, Yue (Queen Mary University of London)
Chorti, Arsenia (Princeton University)
Cosman, Pam (UC, San Diego)
Effros, Michelle (California Institute of Technology)
Ghozi, Raja (ENIT- Tunis)
Gomez Santamaria, Cristina (Universita Pontifica Bolivariana-Colombia)
Gupta, Sumana (IIT Kanpur)
Jackson, Julie (Air Force Institute of Technology)
Kishore, Shalinee (Lehigh University)
Kostina, Victoria (Princeton University)
Kressner, Abbie (Georgia Tech)
Li, Yao (Rutgers University)
Ostendorf, Mari (University of Washington)
Roger, Sandra (Technical University of Valencia)
Shlayaan, Neveen (University of Nevada)
Stojanovic, Milica (Northeastern University)
Summerson, Samantha (Rice University)
Testoni, Vanessa (UC, San Diego)
Wilson, Sarah Kate (Santa Clara University)
Wood, Sally (Santa Clara University)
Xie, Hongmei (Lehigh University)
Zhu, Hao (University of Minnesota)

Inductive Constructions in Rigidity Theory
July 20-22, 2012

Organizers:

Bill Jackson (University of London)
Tibor Jordan (Eotvos University)
Brigitte Servatius (Worcester Polytechnic Institute)
Meera Sitharam (University of Florida)
Walter Whiteley (York University)

This workshop was a 2 day extension of the 5 day workshop: 12w5069: Rigidity Theory: Progress, Applications and Key Open Problems, Jul 15 - Jul 20, 2012. This workshop focussed on inductive techniques which have risen to new prominence with the results and the conjectures highlighted in the previous section. This is an area which featured:
(i) the arrival of a new generation of researchers, at multiple centers around the world;
(ii) insights and new questions coming from fields of application;
(iii) the evolving community and interactions of people following on from the Fields Institute Special Semester on Discrete Geometry, where most of the participants were present, and several new inductive results were refined.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2181

Participants:

Alfakih, Abdo (University of Windsor)
Chavez, Laura (Universidad Autonoma Metropolitana)
Cheng, Jialong (University of Florida)
Connelly, Robert (Cornell University)
Finbow-Singh, Wendy (St. Mary's University)
Hempel, Maria (ETH Zurich)
Jackson, Bill (University of London)
Jordan, Tibor (Eotvos University)
Kaszanitzky, Viktória (Eötvös Loránd University)
Kiraly, Csaba (Eotvos University)
Kitson, Derek (Trinity College Dublin)
Lee-St.John, Audrey (Mount Holyoke)
Nguyen, Viet Hang (University of Grenoble)
Nixon, Tony (University of Bristol)
Owen, John (Siemans)
Pak, Igor (UCLA)
Power, Stephen (University of Lancaster)
Schulze, Bernd (York University)
Servatius, Brigitte (Worcester Polytechnic Institute)
Servatius, Herman (WPI)
Sitharam, Meera (University of Florida)
So, Anthony Man-Cho (CUHK)
Theran, Louis (Freie Universität Berlin)
Whiteley, Walter (York University)

Theoretical and Applied Aspects of Nonnnegative Matrices
July 27-29, 2012

Organizers:

Shaun Fallat (University of Regina)
Daniel Szyld (Temple University)
Michael Tsatsomeros (Washington State University)
Pauline van den Driessche (University of Victoria)

This workshop encouraged participation not only from established researchers who may study both classical nonnegative matrix theory and more modern approaches to this vast area, including some applications, but also from more junior researchers who are presently making their mark on this growing subject area. In particular, graduate students and postdoctoral fellows were invited to attend and participate. The speakers at the workshop reported on recent progress and also brought open problems and challenges to the table for discussion.

The short workshop provided researchers working in this area an opportunity to present their current research, to identify future important challenges, to develop techniques with junior researchers, and to begin research on these identified problems. This workshop served to establish important connections between individual researchers, and promoted collaboration as well as exciting new research.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2156

Participants:

Barrett, Wayne (Brigham Young University)
Bodine, Elizabeth (Cabrini College)
Cavers, Michael (University of Calgary)
Erickson, Craig (Iowa State University)
Garnett, Colin (University of Victoria)
Guo, Chun-Hua (University of Regina)
Hogben, Leslie (Iowa State University)
Marechal, Pierre (University of Victoria)
McDonald, Judi (Washington State University)
Nasserasr, Shahla (University of Regina)
Shader, Bryan (University of Wyoming)
Shaked-Monderer, Naomi (Emek Yezreel College)
Stuart, Jeff (Pacific Lutheran University)
Szyld, Daniel (Temple University)
Tarazaga, Pablo (Texas A&M Univ. Corpus Christi)
Tsatsomeros, Michael (Washington State University)
van den Driessche, Pauline (University of Victoria)
Wang, Shawn (University of British Columbia)
Wilson, Ulrica (Morehouse College)

Math Kangaroo Contest
August 3-5, 2012

Organizers:

Rossitza Marinova (Concordia University College of Alberta) **Valeria Pandelieva** (Canadian Math Kangaroo Contest)

The objectives of the BIRS workshop were to share experiences and have discussions on:
(i) organizing training sessions as well as preparing training material;
(ii) running math clubs and groups;
(iii) how to financially support activities;
(iv) pre-contest activities, contest day, post-contest activities;
(v) expanding the competition locally and nationally;
(vi) informing the community about the Math Kangaroo program by hosting workshops and seminars for teachers and educators;
(vii) gathering national and local coordinators as well as meet new coordinators and help them in the organization of the contest in their city/school;
(viii) sending winners in Europe to participate in math camps; and
(ix) organizing math camps in USA and Canada for winners from USA, Canada, Mexico, France, Romania, Bulgaria, Poland, and others.

The workshop consisted of three sessions. The participants who have been involved in the organization of the Math Kangaroo contest shared their experiences and ideas with others.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2184

Participants:

Bhandari, Ganesh (Mount Royal University)
Chrysostomou, Sophie (University of Toronto)
Halvorsen, John (Concordia University College of Alberta)
Hamilton, Gordon (MathPickle)
Haque, Anis (University of Calgary)
Hitesman, Josey (Concordia University College of Alberta)
Huynh, Kathy (Edmonton Math Kangaroo)
Kharaghani, Hadi (University of Lethbridge)
Krishnamurthy, Ashok (Mount Royal University)
Liu, Claire (University of Calgary)
Marinov, Tchavdar (Southern University at New Orleans)
Marinova, Rossitza (Concordia University College of Alberta)
Melcher, Jonathan (University of Alberta)
Murray, Lois (Dalhousie University)
Pandeliev, Todor (Irdeto Corporation)
Pandelieva, Valeria (Canadian Math Kangaroo Contest)
Petterson, Keelan (Silvercrest Contracting Inc.)
Rudnick, Johan (Canadian Mathematical Society)
Sherman, Mooney (IEEE Northern Canada)
Svishchuk, Mariya (Mount Royal University)

G4G, Gathering for Gardner, Puzzles in the Classroom
October 26-28, 2012

Organizers:

Sean Graves (University of Alberta)
Janice Hoffman (Edmonton Public Schools)
Tiina Hohn (Grant MacEwan University)

This workshop was intended for teachers of all levels of our schools to introduce puzzles and problems in their classrooms as well as to teach good solving practices. This was done as a classroom activity and as a math fair celebration of mathematical logic problems. Problem solving is one of the curriculum requirements of the recently implemented western protocol in Alberta schools. In service, teachers are asking for more help and material to make this happen in their classrooms.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2187

Participants:

Ani, Lona (Grandview Heights School in Edmonton)
Carson, Rosalind (Calgary Schools)
Cooke, Mike (Princess Margaret Secondary School)
Dattani, Rakhee (Crossing Park School)
Denman, Shawna (Summerland Middle School)
Desaulniers, Shawn (Okanagan College)
Graves, Sean (University of Alberta)
Hamilton, Gordon (MathPickle)
Headington, Ashley (Vernon Schools B.C.)
Hildebrandt, Maxine (Mother Earth's Children's Charter School)
Hoffman, Janice (Edmonton Public Schools)
Hohn, Tiina (Grant MacEwan University)
Jubensvill, Heather (Steele Heights School in Edmonton)
Lewis, Ted (SNAP Mathematics Foundation)
Majeau, Marie (PPI Solutions)
McLaughlin, David (Grant MacEwan College)
Phelan, Kathleen (Calgary Schools)
Renert, Aaron (Calgary Bright Minds)
Semenko, Svitlana (Edmonton Schools)
Strungaru, Nicolae (Grant MacEwan University)

Early Years Spatial Reasoning: Learning and Teaching
November 23-25, 2012

Organizers:

Brent Davis (University of Calgary)
Krista Francis-Poscente (University of Calgary)
Joan Moss (University of Toronto)
Yukari Okamoto (UC, Santa Barbara)
Nathalie Sinclair (Simon Fraser University)
Walter Whiteley (York University)

Spatial reasoning is integral to the ability to solve mathematical problems, yet classrooms across North America focus almost entirely on numbers. This workshop brought together researchers with diverse perspectives to collaborate and learn how spatial reasoning processes are (and can be) integrated in the classroom. The following three questions were explored:
(1) How do children demonstrate and communicate spatial reasoning?
(2) How do teachers and researchers recognize spatial reasoning?
(3) How is spatial reasoning developed?
Insight into these questions provided important understanding for developing mathematical talent in young children.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/2-day-workshops/12w2189

Participants:

Andrews, Heather (University of Calgary)
Bruce, Cathy (Trent University)
D'Amour, Lissa (University of Calgary)
Davis, Brent (University of Calgary)
Doolittle, Edward (First Nations University of Canada)
Drefs, Michelle (University of Calgary)
Flynn, Tara (Trent University)
Francis-Poscente, Krista (University of Calgary)
Gerofsky, Susan (University of British Columbia)
Hagen, Pam (PhD Candidate & Elementary educator)
Hawes, Zack (University of Toronto)
Jackiw, Nicholas (KCP Technologies)
Kaur, Harpreet (Simon Fraser University)
Kotsopoulos, Donna (Wilfrid Laurier University)
Lamadrid González, Patricia (CINVESTAV)
LeFevre, Jo-Anne (Carleton University)
McGarvey, Lynn (University of Alberta)
Moss, Joan (University of Toronto)
Preciado Babb, Armando Paulino (University of Calgary)
Ruttenberg, Robyn (York University)
Sinclair, Nathalie (Simon Fraser University)
Tepylo, Diane (University of Toronto)
Thom, Jennifer (University of Victoria)
Thomas, Kevin (York University)
Towers, Jo (University of Calgary)
Twyman, Alexandra (University of Western Ontario)
Winters, Katie (University of Calgary)

Banff International Research Station

2012

Summer Schools
Research in Teams
Focussed Research Groups

Summer Schools

Contemporary Methods for Solving Diophantine Equations
June 10-17, 2012

Organizers:

Michael Bennett (University of British Columbia)
Nils Bruin (Simon Fraser University)
Yann Bugeaud (Universite de Strasbourg)
Bjorn Poonen (MIT)
Samir Siksek (University of Warwick)

Diophantine equations are used to derive solutions that are whole numbers. They are named after Diophantus of Alexandria, a 3rd Century Greek mathematician, even though the subject is much older. For over 350 years, one of the most famous problems in Mathematics had been "Fermat's Last Theorem," named after Pierre de Fermat (1601--1665), which claims that a certain equation similar to the Pythagorean equation has no solutions. This claim was finally established by Andrew Wiles in 1995. The recent methods introduced by Wiles and others to prove Fermat's Last Theorem are applicable to many families of Diophantine equations. However, these techniques are fairly abstract and beginners find the subject very difficult to penetrate. This summer school introduced graduate students to these contemporary methods and prepared them to apply them productively in their own work.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/summer-schools/12ss131

Participants:

Balakrishnan, Jennifer (Harvard University)
Banwait, Barinder (Warwick University)
Bartolome, Boris (Université Bordeaux I)
Beloi, Alex (UC, Santa Cruz)
Bennett, Michael (University of British Columbia)
Bruin, Nils (Simon Fraser University)
Bruni, Carmen (University of British Columbia)
Bugeaud, Yann (Universite de Strasbourg)
Caley, Timothy (University of Waterloo)
Cesnavicius, Kestutis (MIT)
Chisholm, Sarah (University of Calgary)
Deines, Alyson (University of Washington)
Dose, Valerio (University of Rome 2)
Dunn, Scott (University of South Carolina)
Engberg, Zeb (Dartmouth College)
Florez, Jorge (CUNY)
Freitas, Nuno (University of Barcelona)
Ghadermarzi, Amir (University of British Columbia)
Goedhart, Eva (Bryn Mawr College)
Guy, Richard (University of Calgary)
Keil, Stefan (Humboldt University Berlin)
Kreso, Dijana (Graz University of Technology)
Krieger, Holly (University of Illinois Chicago)
Krumm, David (University of Georgia)
Lavasani, Seyed (University of Calgary)
Leppälä, Kalle (University of Oulu)
Leshin, Jonah (Brown University)
Loughran, Daniel (Universite de Paris 7)
Mantilla-Soler, Guillermo (UBC)
McMahon, Ryan (Simon Fraser University)
McNew, Nathan (Dartmouth College)
Mendes da Costa, Dave (University of Bristol / ENS)
Mercuri, Pietro (University of Rome 1)
Najman, Filip (University of Zagreb)
Newton, Rachel (Cambridge University)
Park, Jennifer (MIT)
Poonen, Bjorn (MIT)
Purkait, Soma (University of Warwick)
Rault, Patrick (SUNY-Geneseo)
Sha, Min (Université Bordeaux 1)
Siksek, Samir (University of Warwick)
Sofos, Efthymios (University of Bristol)
Sorvisto, Dayne (University of Calgary)
Spicer, Simon (University of Washington)
Thorne, Frank (University of South Carolina)
Top, Jaap (University of Groningen)
West, Lloyd (CUNY Graduate Center)

2012 Summer IMO Training Camp
June 24-July 8, 2012

Organizers:

Gertrud Jeewanjee (Canadian Mathematical Society) **Robert Morewood** (YWorld.com)

The 2012 Summer IMO Camp had several goals. It created an opportunity for IMO team members to strengthen their problem solving skills in relevant competition areas, assisted by a team of trainers and leaders, in preparation for the International Mathematical Olympiad. The camp also provided an indispensable opportunity for these students to get to know each other before the competition and bonded the team together.Finally, the camp allowed IMO trainers to acquaint the members of the IMO team with some of the rules of the IMO, which are essential for successful participation at the IMO.

At the IMO, the team received six medals – three gold, one silver and two bronze – and an impressive overall standing of fifth place overall in the world. To view the full results visit: *http://www.imo-official.org/team_r.aspx?code=CAN&year=2012*. Part of the credit for this must go to BIRS, which because it's unique academic environment with sufficient isolation from distractions to help the focus of the students, provided the ideal location for the training camp.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/summer-schools/12ss012

Participants:

Arthur, David (Google)
Brennan, Matthew (Upper Canada College)
Chu, Weilian (Old Scona Academic in Edmonton)
Deng, Calvin (NC School of Science & Math Cary)
Fink, Alex (North Carolina State University)
Furmaniak, Ralph (Stanford University)
Lai, Leo (Sir Winston Churchill Secondary)
Rickards, James (Colonel By Secondary School Ottawa)
Shorser, Lindsey (University of Toronto)
Song, Alex (Phillips Exeter Academy Waterloo)
Spink, Hunter (Western Canada H.S. Calgary)
Spivak, Daniel (Bayview Secondary School Thornhill)
Sun, Kevin (Kennedy Jr. High)
Tsimerman, Jacob (Princeton)
Zhou, Kevin (Woburn C.I. Markham)

Research in Teams

Dialgebras, Leibniz Algebras, and Quasi-Jordan Algebras
April 29-May 6, 2012

Organizers:

Murray Bremner (University of Saskatchewan)
Raul Felipe (Centro de Investigación en Matemáticas)
Michael Kinyon (University of Denver)
Juana Sanchez Ortega (Universidad de Malaga)

This workshop brought together three established researchers in nonassociative algebra (M. R. Bremner from Canada, R. Felipe from Mexico, and L. A. Peresi from Brazil) and one recent Ph.D. (J. Sanchez Ortega from Spain) in order to extend the boundaries of the rapidly developing structure and representation theory of associative and nonassociative dialgebras and related triple systems. In particular, the workshop focussed on Leibniz algebras and quasi-Jordan algebras, and the dialgebra analogues of Lie, anti-Lie, Jordan and anti-Jordan triple systems. The participants also studied the recent work of Russian mathematicians in this area, especially the school based at the Sobolev Institute in Novosibirsk (Bokut, Kolesnikov, Pozhidaev). The goal was to extend the categorical approach of the Russian Mathematicians in new directions and discover new algebraic structures which provide further natural generalizations of the classical theories of associative and nonassociative algebras, triple systems, and multioperator algebras.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit142

Isomorphisms and Isometries of Spaces of Continuous Functions
May 13-20, 2012

Organizers:

Garth Dales (University of Lancaster)
Frederick Dashiell (UCLA)
Anthony To-Ming Lau (University of Alberta)
Dona Strauss (University of Leeds)

Banach spaces are an infinite-dimensional generalization of normal finite-dimensional space. They are studied by considering their first and second "dual" spaces. At this workshop, the Banach space $C(K)$ of all continuous functions on certain sets K such as the unit interval was explored. In two memoirs, the first and second dual spaces of the spaces $C(K)$ were considered. At this meeting, scientists considered which spaces of the form $C(K)$ are the first or second duals of some other Banach spaces.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit146

Toric Boij-Söderberg Theory
May 20-27, 2012

Organizers:

Christine Berkesch (Duke University)
Daniel Erman (University of Michigan)
Gregory Smith (Queen's University)

The fundamental goal of this workshop was to create a version of Boij-Söderberg theory relating sheaf cohomology on a toric variety to multigraded free resolutions over the associated Cox ring. Although such a theory would clearly provide important new insights into both the study of vector bundles and the study of free resolutions, there has so far been little progress in this direction. However, recent discoveries by David Eisenbud and Daniel Erman (preprint to appear in 2012) suggested a new approach. Specifically, Eisenbud and Erman provided a more robust and transparent construction for the duality pairing appearing in the Boij-Söderberg theory on projective space. This workshop capitalized on this advancement by formulating a toric generalization of this duality pairing. The participants focussed on toric surfaces as their basic testing ground. In addition to theoretical considerations, they also used computational experimentation with the Macaulay2 software system to guide their research.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit171

A New Implementation of Fletcher's Exact Merit Function for Nonlinear Optimization
May 27-June 3, 2012

Organizers:

Michael Friedlander (UBC)
Dominique Orban (Ecole Polytechnique de Montreal)

In this project, participants revisited a numerical method for optimization proposed by Fletcher in 1973. At that time, numerical computing and the solution of simpler optimization problems may not have been sufficiently developed for this method to show its full potential. The process appeared to be computationally expensive and slow. Also, this method had not been cited much in later literature, thus leading to the belief that this method is almost forgotten. Today however, we understand the subproblems well and possess numerical procedures to attack them efficiently and accurately. This experience with an initial resurrection of Fletcher's method was not only encouraging, but competitive with our state of the art!

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit180

Strong Asymptotics for Cauchy Biorthogonal Polynomials
June 10-17, 2012

Organizers:

Marco Bertola (Concordia University)
Misha Gekhtman (University of Notre Dame)
Jacek Szmigielski (University of Saskatchewan)

The main objective of the workshop was to bring the research on the asymptotics of Cauchy biorthogonal polynomials to a satisfactory conclusion and apply it to the universality of the two-matrix model. The participants concluded that for sufficiently smooth measures at the edge of the support, the universality class will be the same as for the corresponding one-matrix model.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit173

Renormalization Group Methods for Polymer and Last Passage Percolation Models
July 22-29, 2012

Organizers:

Tom Alberts (California Institute of Technology)
Yuri Bakhtin (Georgia Institute of Technology)
Eric Cator (TU Delft)
Konstantin Khanin (University of Toronto)

This program attempted to understand and classify the universal statistical behaviour occurring in important models of statistical mechanics. The platform brought together researchers from four different universities to study what has already been done in the renormalization group context, and then to determine what future results can be expected. The universal statistics derived from this work were expected to have eventual applications in fields as diverse as chemistry, biology, physics, and materials science.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit174

Models for Minimal Cantor Z^2 systems
August 5-12, 2012

Organizers:

Thierry Giordano (University of Ottawa)
Ian Putnam (University of Victoria)
Christian Skau (Norwegian University of Science & Technology)

The goal of this workshop was to find a model, which takes, as its data, cohomological information of the system and produces concrete examples. The first goal achieved involved correcting this apparent gap in the development of the theory. Secondly, it was a well-observed phenomenon that the actions of Z^d are radically different from that of Z and the workshop's results shedded light on the situation in the topological case and, in particular, provided a new technique for finding examples. Finally, there have been interesting connections between the participants' work in the Z case and George Elliott's classification program for amenable C*-algebras. That program has ran into a bit of a roadblock for actions of Z^d and the workshop shedded some light on the difficulties.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit170

Moduli Spaces in Conformal Field Theory and Teichmuller Theory
August 12-19, 2012

Organizers:

Yi-Zhi Huang (Rutgers University)
David Radnell (American University of Sharjah)
Eric Schippers (University of Manitoba)
Wolfgang Staubach (Uppsala University)

Conformal field theories are physical models of statistical or quantum mechanical field theories with local invariance under scale and rotation. The mathematical theory of two-dimensional conformal field theories is very rich and has led to many fundamental advances in different branches of mathematics. The workshop used a recently discovered link between conformal field theory and quasiconformal Teichmuller theory, to solve outstanding analytic problems arising in the rigorous construction of two-dimensional conformal field theory from vertex operator algebras.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit139

Random Gradient Models with Degenerate Potential
September 9-16, 2012

Organizers:

Codina Cotar (Toronto)

Feng Yu (University of Bristol)

Gradient models are a class of models arising in the study of random interfaces and of elasticity theory. A lot is known about such models when the interaction satisfies certain strict convexity assumptions and when no disorder is present in the system. For models which are more realistic approximations of the physical phenomena involved, such as models with non-convex interactions or models with disorder, much less is known and there are still many interesting open problems.

The main goal of this project was to study interface models with degenerate disorder, which are more realistic approximations of the physical phenomena involved as they take account of impurities in the system, which can affect, for example, the potentials, or the configurations of the system on which the interface appears. The model studied proved that the interaction is random and may be 0 with a fixed probability. Consequently, this model effectively became a gradient interface model defined on a percolation configuration, and held exciting connections to random walks with random conductances. The following were investigated: questions of existence of infinite volume Gibbs measures, uniqueness, and central limit theorem, as well as the decay of correlations under various assumptions on the potentials. Degeneracy posed a serious challenge in this case, although that also made the problem extremely interesting.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit185

Positive Semidefinite Zero Forcing and Applications
September 23-30, 2012

Organizers:

Craig Larson (Virginia Commonwealth University)
Brian Lins (Hampden-Sydney College)
Lon Mitchell (American Mathematical Society)
Simone Severini (University College London)

The study of positive semidefinite zero forcing for bipartite graphs has potential applications to all of zero forcing, a subject only recently created/discovered, as well as to control quantum systems and problems in linear algebra and matrix theory. This research team considered a number of open questions in this area and provided answers and applications.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit167

Sarason Conjecture and the Composition of Paraproducts
November 4-11, 2012

Organizers:

Eric Sawyer (McMaster University)

Brett Wick (Georgia Tech)

A set of discrete paraproduct operators are fundamental in harmonic analysis since they serve as dyadic examples of Calderón-Zygmund operators. Additionally, they are connected to questions in analytic function theory through Sarason's Conjecture about Toeplitz operators on the Hardy Space. This Research in Teams studied the question of the boundedness of the composition

$$\mathrm{P}_b^{\epsilon,\delta}\mathrm{P}_\beta^{\epsilon',\delta'}: L^2(\mathbb{R}) \to L^2(\mathbb{R})$$

and what are the conditions on the symbols b and β that characterize the boundedness of this operator. This meeting brought together Eric T. Sawyer, Maria Cristina Pereyra, Maria Carmen Reguera and Brett D. Wick to address the question about boundedness of the composition of paraproducts. Each of these mathematicians brought unique expertise, background, and motivations for this problem. This team effort attempted to bring a resolution to this question by using recent advances in harmonic analysis and operator theory.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/research-in-teams/12rit186

Participants:

Pott, Sandra (Lund Univeristy)

Reguera Rodriguez, Maria (Lund University)

Focussed Research Groups

Novel Approaches to the Finite Simple Groups
April 22-29, 2012

Organizers:

Roland Friedrich (Humboldt-Universität zu Berlin)
John McKay (Concordia University)

The purpose of this research group was to familiarize specialists with others in the context of addressing the question of finding a "natural" home for the sporadic simple groups and, in particular, the monster group and the phenomena associated with it. The two organizers presented a series of papers.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg158

Participants:

Doran, Charles (University of Alberta)
Hesselholt, Lars (Nagoya University)
Laca, Marcelo (University of Victoria)
Marcolli, Matilde (California Institute of Technology)
Morava, Jack (Johns Hopkins University)
Plazas, Jorge (Concordia University)

Geometrization of Smooth Characters
May 6-13, 2012

Organizers:

Pramod N. Achar (Louisiana State University)
Clifton Cunningham (University of Calgary)
Masoud Kamgarpour (UBC)
Hadi Salmasian (Université d'Ottawa)

One of the cornerstones of Langlands conjectures, the local Langlands Correspondence, though known for general linear groups and a handful of low-rank groups, remains an open problem. This Research Team acted as a collection of geometrically-minded representation theorists who worked on developing new techniques for representation theory by adapting the theory of character sheaves to the study of admissible representations, with a view to the local Langlands Correspondence.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg163

Participants:

Roe, David (University of Calgary)

The D-Bar Method: Inverse Scattering, Nonlinear Waves, and Random Matrices
July 29-August 5, 2012

Organizers:

Ken McLaughlin (University of Arizona)

Peter Perry (University of Kentucky)

International experts gathered at BIRS for a two-week intensive research focus on the "∂-method" in inverse scattering theory. Examples of inverse scattering included medical imaging, in which images of a patient are reconstructed from the patient's response to electromagnetic radiation, and geophysical prospection, in which underground reservoirs of oil are located by surface measurements of acoustic waves. In each case, the physical process (propagation of electromagnetic or acoustic waves) is governed by a partial differential equation (PDE) which depends on the quantity to be reconstructed. The "inverse" problem used measurements of the solution of the PDE to find the physical quantity--that is, to "invert" the solution to find the equation. In a fascinating mathematical twist, the inverse scattering method can be used to solve so-called completely integrable differential equations, including nonlinear equations which model the propagation of nonlinear waves in fluids, optical media, and plasmas. Moreover, the same "completely integrable method" can be applied to solve problems in the theory of orthogonal polynomials, with applications to approximation theory; random matrix models, which are used to model the statistics of nuclear energy levels, to study quantum chaotic scattering, to understand certain two-dimensional quantum field theories, and many other areas of applied science.

The purpose of this intensive workshop was to make progress in the study of 2+1-dimensional (two space, one time) differential equations, and related problems in the study of normal matrices and orthogonal polynomials. The analog of the Riemann-Hilbert method in this setting was the ∂-method, which the participants refined and developed collaboratively by focussing, at first, on very specific problems which admitted a complete solution and provided valuable insight into the structure of an anticipated general method. The methods developed will provide new mathematical tools to study nonlinear wave propagation as well as mathematically related problems in probability theory, approximation theory, and quantum physics.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg176

Participants:

Astala, Kari (University of Helsinki)
Christ, Michael (University of California, Berkeley)
Miller, Peter (University of Michigan)
Siltanen, Samuli (University of Helsinki)

The p-adic Langlands Program for Non-split Groups
August 19-26, 2012

Organizers:

Caraiani, Ana (University of Chicago)
Matthew Emerton (University of Chicago)
Gee, Toby (Imperial College London)
Geraghty, David (Princeton University)
Paskunas, Vytautas (Universitaet Duisburg-Essen)
Shin, Sug Woo (MIT)

The Langlands program was originally formulated as a link between number theory and analysis, but over the last 40 years, it has grown to link together much of pure mathematics, including geometry, topology, and (in the recent work of Witten and collaborators) S-duality in quantum field theory. Three Fields medals (the mathematical equivalent of the Nobel prize) have been awarded in the last twenty years for work on the Langlands program, and its importance as a central part of pure mathematics is hard to overstate. Several of the biggest recent advances in the field have been due to developments in the p-adic Langlands program, an exciting new generalisation of the Langlands program. The p-adic Langlands program is still at a nascent stage, and the focussed research group made significant progress on developing new instances of it.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg159

A t-Pieri Rule for Hall-Littlewood P-functions and QS(t)-Functions
August 26-September 2, 2012

Organizers:

James Haglund (University of Pennsylvania)
Stephanie van Willigenburg (UBC)

The study of Macdonald polynomials is a dynamic and growing area of mathematics due to its connections to other areas such as algebraic geometry, representation theory and physics. Thus, understanding them is considered to be highly desirable. For example, Haiman was awarded the 2004 AMS Moore prize for his work on them and the discovery of a proof by Haglund, Haiman and Loehr of a combinatorial formula, conjectured earlier by Haglund, was a substantial breakthrough that appeared in the prestigious Journal of the American Mathematical Society. Building on the success of the BIRS Research in Teams program "Schur quasisymmetric functions and Macdonald polynomials," the recent 2011 BIRS 5-day workshop "Algebraic Combinatorixx," and prior to this, the 2007 BIRS 5-day workshop "Applications of Macdonald Polynomials," Soojin Cho (Ajou University), James Haglund (University of Pennsylvania), Sarah Mason (Wake Forest University), Vasu Tewari (University of British Columbia), Stephanie van Willigenburg (University of British Columbia) and Meesue Yoo (Seoul National University) furthered the knowledge of Macdonald polynomials by proving Yoo's conjecture for a t-Pieri rule for Hall-Littlewood P-functions and QS(t)-functions at this meeting. This breakthrough will support an exciting conjecture of Haglund on nonnegative integral coefficients of a product of a Schur function and a Hall-Littlewood P-function, which are two celebrated instances of Macdonald polynomials.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg164

Participants:

Cho, Soojin (Ajou University)
Mason, Sarah (Wake Forest University)
Tewari, Vasu (UBC)
Yoo, Meesue (Korea Institute for Advanced Study)

The Advent of Quark-Novae: Modeling a New Paradigm in Nuclear Astrophysics
September 2-9, 2012

Organizers:

Rachid Ouyed (University of Calgary)

Different aspects of the Quark-Nova model have been developed at universities around the world. The purpose of this workshop was to collect the most active and capable contributors in this emerging field to share and stimulate research in the astrophysics of the Quark-Nova. More specifically, the objectives of this meeting were threefold: First, a status review of the progress made in the fundamental aspects of the quark-nova model and the quantum chromodynamics (QCD) phase transition at high density was conducted. Second, a critical examination of the observational successes of the Quark-Nova model pertaining to nucleosynthesis and the chemical evolution of the Galaxy was conducted. Finally, new directions for the development and refinement of the Quark-Nova model were discussed.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg183

Participants:

Koning, Nico (University of Calgary)
Kostka, Mathew (University of Calgary)
Leahy, Denis (University of Calgary)
Niebergal, Brian (University of Calgary)
Ouyed, Amir (University of Calgary)
Staff, Jan (Louisiana State University)
Thompson, Adam (University of Calgary)

Generalized Gauss Maps and Farey Statistics
September 16-23, 2012

Organizers:

Jayadev Athreya (UIUC)
Jonathan Chaika (University of Chicago)
Yitwah Cheung (San Francisco State University)
Samuel Lelievre (Université Paris-Sud)
Anthony Quas (University of Victoria)

Many important problems in Number Theory pertains to the distribution of various randomly occurring numbers, (e.g. the Riemann Hypothesis is concerned with the distribution of prime numbers). Sometimes, the randomness can be explained by means of a classical dynamical system, in which case, the powerful tools of ergodic theory can be brought to bear. However, it is very difficult to predict when this will happen in general. Thus, this research group looked at the Farey sequences, whose relation to horocycle flows have recently been discovered, and sought to improve the range of random phenomena that can be understood in terms of classical dynamical systems.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg172

Participants:

Chevallier, Nicolas (Université de Haute Alsace)
Tseng, Jimmy (UIUC)

Supercharacters and Hopf Monoids
October 7-14, 2012

Organizers:

Nantel Bergeron (York University)

Consider matrices with n rows and n columns, with 1's down the diagonal, 0's under the diagonal and arbitrary entries chosen in a finite field above the diagonal. We can multiply to such matrices and obtain a matrix of the same kind, and for any such matrix, we can find another one such that when we multiply them, we get the identity matrix. This set of matrices form the group of n by n unipotent upper-triangular matrices. This research team was interested in the representation of this group, that is the way that it can transform different spaces. In general, this problem has been known to be impossible to describe, so this team concentrated its attention to a well-behaved family (super-representations) of representations for these groups (one for each n). This family has a nice structure that the team described precisely in a recent paper. The aim of the present focus research group was to develop further, this (super)theory for other kind of groups and algebraic structures. To help the group proceed successfully in this task, participants have recently discovered that there are more natural algebraic tools (Hopf monoids) to describe the super-representations in many cases.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg166

Participants:

Aguiar, Marcelo (Texas A & M)
Benedetti, Carolina (York University)
Lauve, Aaron (Loyola University Chicago)
Saliola, Franco (Université du Québec à Montréal)
Thiem, Nathaniel (University of Colorado Boulder)

Animal Movement and Memory
October 21-28, 2012

Organizers:

William Fagan (University of Maryland)

Mark Lewis (University of Alberta)

With the accumulation of biological evidence, there exists a clear opportunity (and need) to develop new mathematical representations of movement mechanisms involving spatial memory. Representations of a cognitive map may involve a utility function that denotes the perceived value of a location over time. Here, the value of the utility function may be derived directly from a location's foraging potential or indirectly, from its potential to provide information relevant to patrolling and similar behaviours. The movement model can rely on the utility function to determine where to move. The movement process, in turn, can be described as a stochastic process, or modelled using partial differential equations with nonlocal operators where there is bias towards area of high potential utility.

One challenge is to determine the degree to which animals choose to maximize short-term utility (eg., foraging in a meadow) versus long-term utility (eg., migrating long distances for breeding or future resources) when making movement decisions. If fitness can be determined, the issue of optimality may come into play and this may ultimately help determine the beaviour. How does an animal choose a movement behaviour so as to maximize its fitness, particularly when there are other players with similar goals? Properly addressing these important issues will require new mathematical ideas and close, on-going collaborations between researchers who build and analyze models (mainly mathematicians) and those who study how spatial memory works in practice (mainly behavioral ecologists).

This research group brought together a small number of experts in both areas to develop robust and biologically realistic mathematical representations of spatial memory. By mixing top mathematicians and quantitatively skilled behaviorists together in the workshop, good progress was made towards the development of mathematical models that capture more fully the rich diversity of movement mechanisms that have evolved in nature.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg155

Participants:

Auger-Methe, Marie (University of Alberta)
Avgar, Tal (University of Guelph)
Benhamou, Simon (CNRS Montpellier)
Breed, Greg (University of Alberta)
Ladage, Lara (University of Nevada, Reno)
Mueller, Thomas (University of Maryland)
Schlaegel, Ulrike (University of Alberta)
Tang, Wenwu (University of North Carolina at Charlotte)

Spectral and Asymptotic Stability in Nonlinear Dirac Equations
December 2-12, 2012

Organizers:

Nabile Boussaid (Université de Franche-Comté)
Stephen Gustafson (UBC)
Andrew Comech (Texas A & M)

The broad goal of this research group was to develop an understanding of properties of nonlinear Dirac solitary waves, especially concerning their stability, by building upon a few very recent advances, and by developing novel techniques. The methods developed and refined were more widely applicable to the Dirac-Maxwell system from Quantum Electrodynamics, and to the coupled mode equations which appear in Solid State Physics and Nonlinear Optics.

The research lied at the borderline of Mathematics and Physics, and was directly related to Optics, Waveguide Theory, Field Theories, Solid State Physics, and High Energy Physics. Its mathematical tools were rooted in Harmonic and Functional Analysis, Spectral Theory, and Partial Differential Equations. This interconnection of several disciplines allowed scientists to engage top experts from adjacent fields, who represent the main body of the group. The focused research group at BIRS provided a unique opportunity for this geographically diffuse collection of specialists to combine forces to solve a specific set of pressing problems.

For details, please refer to the workshop webpage
http://www.birs.ca/events/2012/focussed-research-groups/12frg188

Participants:

Ibrahim, Slim (University of Victoria)
Mizumachi, Tetsu (Kyushu University)
Nakanishi, Kenji (Kyoto University)
Stefanov, Atanas (University of Kansas)

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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