



Banff International Research Station

for Mathematical Innovation and Discovery

2013 Annual Report



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5-Day Workshops 2013

Jan 13	Jan 18	New Perspectives on the \mathbb{N}^n -body Problem
Jan 20	Jan 25	Selective Transport through Biological and Bio-Mimetic Nano-Channels: Mathematical Modeling Meets Experiments
Jan 27	Feb 1	Algebraic Geometry and Geometric Modeling
Feb 3	Feb 8	Topological Phenomena in Quantum Dynamics and Disordered Systems
Feb 10	Feb 15	Holography and Applied String Theory
Feb 17	Feb 22	Probabilistic Approaches to Data Assimilation for Earth Systems
Feb 24	Mar 1	Asymptotics of Large-Scale Interacting Networks
Mar 3	Mar 8	Applications of Iwasawa Algebras
Mar 10	Mar 15	Interplay of Convex Geometry and Banach Space Theory
Mar 17	Mar 22	CosmoStat2013: Statistical Challenges from Large Data Sets in Cosmology and Particle Physics
Mar 24	Mar 29	Interactions of Gauge Theory with Contact and Symplectic Topology in Dimensions 3 and 4
Mar 31	Apr 5	Partial Differential Equations in the Social and Life Science: Emergent Challenges in Modeling, Analysis, and Computations
Apr 7	Apr 12	Mapping Class Groups and Categorification
Apr 14	Apr 19	Arithmetic Groups
Apr 21	Apr 26	Whitney Problems
Apr 21	Apr 26	Graph Algebras: Bridges between Graph C^* -Algebras and Leavitt Path Algebras
Apr 28	May 3	Mathematical Methods in Quantum Molecular Dynamics
May 5	May 10	The Art of Iterating Rational Functions over Finite Fields
May 12	May 17	Impact of Climate Change on Biological Invasions and Population Distributions
May 19	May 24	Non-Gaussian Multivariate Statistical Models and their Applications
May 26	May 31	Mathematical Tools for Evolutionary Systems Biology
Jun 2	Jun 7	Refined Invariants in Geometry, Topology and String Theory
Jun 9	Jun 14	Nonlinear Conservation Laws and Related Models
Jun 16	Jun 21	Rules of Protein-DNA Recognition: Computational and Experimental Advances
Jun 30	Jul 5	Water Waves: Computational Approaches for Complex Problems
Jul 7	Jul 12	Computational Complexity
Jul 14	Jul 19	Mathematics and Mechanics in the Search for New Materials
Jul 21	Jul 26	Permutation Groups
Jul 28	Aug 2	Spectral Theory of Laplace and Schroedinger Operators
Aug 4	Aug 9	Metric Geometry, Geometric Topology and Groups
Aug 11	Aug 16	Statistical Data Integration Challenges in Computational Biology: Regulatory Networks and Personalized Medicine
Aug 18	Aug 23	WIT: Women in Topology
Aug 25	Aug 30	Integrable Systems and Moduli Spaces
Sep 1	Sep 6	Modeling High-Frequency Trading Activity
Sep 8	Sep 13	Random Measures and Measure-Valued Processes
Sep 15	Sep 20	Geometry and Inverse Problems
Sep 22	Sep 27	Uncovering Transport Barriers in Geophysical Flows
Sep 22	Sep 27	Entanglement in Curved Spacetime
Sep 29	Oct 4	Geometric and Topological Graph Theory
Oct 6	Oct 11	The Role of Oceans in Climate Uncertainty
Oct 13	Oct 18	Whittaker Functions: Number Theory, Geometry and Physics
Oct 20	Oct 25	Managing Fire on Populated Forest Landscapes
Oct 27	Nov 1	Disordered Quantum Many-Body Systems
Nov 3	Nov 8	Axiomatic Approaches to Forcing Techniques in Set Theory
Nov 3	Nov 8	Computable Model Theory
Nov 10	Nov 15	Creative Writing in Mathematics and Science
Nov 10	Nov 15	Current Challenges for Mathematical Modelling of Cyclic Populations
Nov 17	Nov 22	Entanglement in Biology; How Nature Controls the Topology of Proteins and DNA
Nov 24	Nov 29	Understanding Relationships between Aboriginal Knowledge Systems, Wisdom Traditions, and Mathematics: Research Possibilities
Nov 24	Nov 29	Operator Algebras and Dynamical Systems from Number Theory
Dec 1	Dec 6	Bi-directional Transformations (BX) – Theory and Applications Across Disciplines
Dec 8	Dec 13	Integral Equations Methods: Fast Algorithms and Applications
Dec 15	Dec 20	Geometric Variational Problems

2-Day Workshops 2013

Apr 26 Apr 28 Ted Lewis Workshop on SNAP Math Fairs 2013
May 10 May 12 Alberta Number Theory Days 2013
Jul 19 Jul 21 A Scientific Retreat for Mathematical Scientists from Western Canada
Aug 2 Aug 4 Inexact Optimization Theory for Resources and Environmental Management
Aug 30 Sep 1 Statistics and Triggering of Earthquakes
Aug 30 Sep 1 Recent Progress on Applied and Computational Harmonic Analysis
Sep 13 Sep 15 Workshop on Stochasticity in Biochemical Reaction Networks
Sep 20 Sep 22 The Science of Network Coding
Sep 27 Sep 29 Mathematical Modeling of Indigenous Populations Health
Nov 8 Nov 10 International Graduate Training Centre in Mathematical Biology Summit
Nov 15 Nov 17 K-12 Unsolved

Summer Schools

Jul 7 Jul 21 2013 Summer IMO Training Camp

Research In Teams

Apr 28 May 5 Estimates for Denominators of Pade Approximants and Applications to Diophantine Equations
Aug 4 Aug 11 Cholera Dynamics on Community Networks
Aug 10 Aug 20 MSI: Music, Film and Mathematics together
Sep 1 Sep 8 Multiscale Analysis of Stochastic Spatial Chemical Reaction Networks
Oct 20 Oct 27 Mathematical Methods for Bar Code Decoding
Oct 27 Nov 3 Smooth Relaxations of Large-Scale Optimization Problems, with Applications to Sparse Optimization and Semidefinite Programming

Focused Research Groups

Mar 17 Mar 24 Effective Computations in Arithmetic Mirror Symmetry
May 5 May 12 Network Models of Financial Systemic Risk
Jun 9 Jun 16 Cerebral Blood Flow, Neurovascular Coupling, and Cortical Spreading Depression
Jun 16 Jun 23 Minimum Rank, Maximum Nullity, and Zero Forcing of Graphs
Jul 21 Jul 28 Numerical Methods for Optimal Transportation
Aug 11 Aug 18 Advancing Deterministic Algorithms for Mixed-Effects Modelling in R

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2013

5-Day Workshops

New Perspectives on the N-body Problem

January 13-18, 2013

Organizers:

Luigi Chierchia (Università ROMA TRE)
Vadim Kaloshin (University of Maryland)

John Mather (Princeton University)
Susanna Terracini (University of Torino)



This workshop was an ideal place to discuss and bring up new ideas in this subject. It brought specialists of the N--body problem together with the leaders of different areas in dynamical systems (Variational Methods, Mather Theory, Hamiltonian dynamics, Ergodic Theory) to build a theoretical framework suitable to attack some of the many unsolved aspects of the N--body problem.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5055>

Participants:

Barutello, Vivina (University of Torino)
Bolotin, Sergey (University of Wisconsin)
Chen, Kuo-Chang (National Tsing Hua University)
Chierchia, Luigi (Università ROMA TRE)
Diacu, Florin (University of Victoria)
Dullin, Holger (University of Sydney)
Féjóz, Jacques (Universite Paris-Dauphine)
Ferrario, Davide L. (University of Milano-Bicocca)
Gronchi, Giovanni Federico (University of Pisa)
Guardia, Marcel (University of Maryland)
Kaloshin, Vadim (University of Maryland)
Khanin, Konstantin (University of Toronto)
Knauf, Andreas (Erlangen-Nuremberg University)
Long, Yiming (Nankai University)
Maderna, Ezequiel (Universidad de la República)
Meyer, Kenneth (University of Cincinnati)
Montgomery, Richard (UC, Santa Cruz)
Offin, Daniel (Queen's University)
Ortega, Rafael (University of Granada)
Palacian, Jesús (Universidad Publica de Navarra)

Perez-Chavela, Ernesto (Universidad Autónoma Metropolitana-iztapalapa)
Pinzari, Gabriella (University 'Roma Tre')
Portaluri, Alessandro (University of Salento)
Roberts, Gareth E. (College of the Holy Cross)
Roldan, Pablo (ETSEIB-UPC)
Seara, Tere M (Universitat Politècnica de Catalunya)
Shibayama, Mitsuru (Osaka University)
Soave, Nicola (University of Milano Bicocca)
Sorrentino, Alfonso (Università di Roma Tre)
Stoica, Cristina (Wilfrid Laurier University)
Sun, Shanzhong (Capital Normal University)
Terracini, Susanna (University of Torino)
Venturelli, Andrea (Univ. Avignon)
Verzini, Gianmaria (Politecnico of Milano)
Xia, Zhihong (Jeff) (Northwestern University)
Xie, Zhifu (Virginia State University)
Xue, Jinxin (University of Maryland)
Zhao, Xiaoxiao (Sichuan University)

Selective Transport Through Biological And Bio-Mimetic Nano-Channels: Mathematical Modeling Meets Experiments

January 20-25, 2013

Organizers:

Michael Elbaum (Weizmann Institute of Science)
Gnana Gnanakaran (Los Alamos National Laboratory)

Tijana Jovanovic-Talisman (University of Hawaii)
Anton Zilman (University of Toronto)



This workshop was devoted to the quantitative understanding of transport through the NPC and related biological and artificial nano-channels, with the goal of elucidating the basic biophysical principles and leveraging these principles towards applications in bio-nano-technology. The focus on a particular, well-characterized system such as the NPC allowed for the development of the concepts and applications of mathematical tools in a systematic manner, continuously checked by the experimental data. With progress in both experiments and theory, clear communication and collaborative efforts of scientist across fields will certainly lead to new advancements in understanding transport through biological and artificial devices.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5135>

Participants:

Adams, Rebecca (Vanderbilt University)
Aebi, Ueli (Basel University)
Albrecht, Tim (Imperial College)
Ananth, Adithya Nagarakodige (Delft University of Technology)
Ando, David (UC Merced)
Asatekin, Ayse (Tufts University)
Chou, Tom (UC, Los Angeles)
Elbaum, Michael (Weizmann Institute of Science)
Frey, Steffen (MPI for Biophysical Chemistry)
Gnanakaran, Gnana (Los Alamos National Laboratory)
Gopinathan, Ajay (UC, Merced)
Gratton, Enrico (UC, Irvine)

Jovanovic-Talisman, Tijana (University of Hawaii)
Keyser, Ulrich (University of Cambridge)
Lim, Roderick (Basel University)
Montel, Fabien (CNRS / Université Paris Diderot)
Musser, Siegfried (Texas A&M)
Rabin, Yitzhak (Bar-Ilan University)
Raveh, Barak (UC, San Francisco)
Richter, Ralf (CIC biomaGUNE)
Stewart, Murray (Medical Research Council)
Wozniak, Richard (University of Alberta)
Yang, Weidong (Temple University)
Zilman, Anton (University of Toronto)

Algebraic Geometry and Geometric Modeling

January 27 - February 1, 2013

Organizers:

Ron Goldman (Rice University)
Jorg Peters (University of Florida)

Frank Sottile (Texas A & M University)



The purpose of this workshop was to foster the deepening and broadening of interactions between algebraic geometry and geometric modeling. These subjects both study curves, surfaces, and solids, but from distinct perspectives. While algebraic geometry is largely concerned with theoretical properties of these objects, geometric modeling uses curves and surfaces to represent objects in a computer for industrial design, manufacture, architecture, and entertainment. These applications of geometric modeling to computer-aided geometric design and computer graphics are profoundly important to the world economy. The past dozen years have seen a trend of deepening interactions between these subjects with ideas and methods flowing in both directions. There remains a significant opportunity for further development, both deepening these interactions, and broadening them both within the subjects and by bringing in people who use these same objects in different fields, such as algebraic statistics or approximation theory.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5062>

Participants:

Bajaj, Chandrajit (University of Texas, Austin)
Borcea, Ciprian (Rider University)
Busé, Laurent (INRIA Sophia Antipolis)
Chen, Falai (University of Science and Technology of China)
D'Andrea, Carlos (University of Barcelona)
Deng, Jiansong (University of Science and Technology of China)
Dokken, Tor (SINTEF ICT)
Elber, Gershon (Technion)
García-Puente, Luis (Sam Houston State University)
Goldman, Ron (Rice University)
Josefsson, Kristoffer (Foster and Partners)
Juettler, Bert (JKU Linz)
Kim, Minh (University of Seoul)
Krasauskas, Rimvydas (Vilnius University)
Lin, Ming (University of North Carolina)
Mann, Stephen (University of Waterloo)
Mourrain, Bernard (INRIA Sophia-Antipolis)
Peters, Jorg (University of Florida)

Piene, Ragni (University of Oslo)
Pottmann, Helmut (King Abdullah University of Science and Technology)
Reif, Ulrich (Technische Universität Darmstadt)
Schaefer, Scott (Texas A & M)
Schenck, Hal (University of Illinois)
Sederberg, Tom (Brigham Young University)
Shi, Xiaoran (Beijing Computational Science Research Center)
Smith, Gregory (Queen's University)
Sorokina, Tatyana (Towson University)
Sottile, Frank (Texas A & M University)
Streinu, Ileana (Smith College)
Taubin, Gabriel (Brown University)
Wang, Wenping (Univ. of Hong Kong)
Wang, Xuhui (Rice University)
Warren, Joe (Rice Univ.)
Zheng, Jianmin (Nanyang Technological University)
Zube, Severinas (Vilnius University)

Topological Phenomena in Quantum Dynamics and Disordered Systems

February 3-8, 2013

Organizers:

Marcel Franz (University of British Columbia)
Netanel Lindner (California Institute of Technology)

Gil Refael (California Institute of Technology)



The workshop brought together top researchers in theoretical and experimental physics, mathematics and quantum information theory, interested in topological phenomena in quantum physics. The objectives of the workshop were twofold. First, to emphasize that this is an interdisciplinary research field, wherein progress requires a combination of expertise ranging from mathematics to condensed matter physics. Second, the multidisciplinary environment provided a unique combination of physical insight and mathematical background to stimulate discovery of new types of topological phenomena in quantum matter.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5158>

Participants:

Akhmerov, Anton (Harvard University)
Armitage, Peter (John Hopkins University)
Auerbach, Assa (Technion)
Avron, Joseph (Technion)
Bardarson, Jens (UC, Berkeley)
Beenakker, Carlo (Leiden University)
Berg, Erez (Weizmann Institute)
Bernevig, Anderi (Princeton University)
Cooper, Nigel (Cambridge University)
Damascelli, Andrea (University of British Columbia)
Drew, Dennis (University of Maryland)
Fidkowski, Lukasz (Caltech)
Fisher, Matthew (UC, Santa Barbara)
Foster, Matthew (Rice University)
Franz, Marcel (University of British Columbia)
Garate, Ion (Yale University)
Gian Michele, Graf (ETH Zurich)
Gorshkov, Alexey (Caltech)
Gurarie, Victor (University of Colorado)
Haldane, F Duncan M (Princeton University)
Hasan, Zahid (Princeton University)

Hastings, Matt (Microsoft Research Station Q)
Hsieh, David (California Institute of Technology)
Hughes, Taylor (University of Illinois)
Klich, Israel (University of Virginia)
Lindner, Netanel (California Institute of Technology)
Loring, Terry (University of New Mexico)
Marchand, Dominic (University of British Columbia)
Meyer, Julia (INAC/SPSMS/GT, CEA Grenoble)
Nascimbene, Sylvain (École Normale Supérieure)
Oreg, Yuval (Weizmann Institute)
Podolsky, Daniel (Technion)
Qi, Xiao-Liang (Stanford University)
Rechtsman, Mikael (Technion)
Refael, Gil (California Institute of Technology)
Rudner, Mark (Niels Bohr Institute)
Ryu, Shinsei (University of Illinois at Urbana)
Seradjeh, Babak (Indiana University)
Seroussi, Inbar (Weizmann Institute of Science)
Shtengel, Kirill (UC, Riverside)

Holography and Applied String Theory

February 10-15, 2013

Organizers:

Johanna Erdmenger (Max Planck Institute for Physics) **Gordon Semenoff** (University of British Columbia)
Sean Hartnoll (Stanford University)



Theoretical and mathematical physicists from leading research groups worldwide converged to brainstorm the potential applications of string theory for understanding a wide array of physical systems, from the behavior of semi-conductors and superconductors to the fireball that is created by the high energy collision of lead atoms. String theory is already famous and sometimes controversial as a candidate for a “theory of everything”. The topic of discussion this week has a different focus, it is about whether the high powered mathematical techniques that string theorists use, and the phenomenally rich structure of the theory itself can be used to solve specific, previously intractable physical problems.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5054>

Participants:

Ammon, Martin (UC, Los Angeles)
Caceres, Elena (University of Texas and University of Colima)
Callebaut, Nele (University of Gent)
Cremonini, Sera (University of Cambridge and Texas A&M)
Dong, Xi (Stanford University)
Erdmenger, Johanna (Max Planck Institute for Physics)
Evans, Nick (University of Southampton)
Herzog, Carlo (ExtreMe Matter Institute EMMI, GSI Darmstadt and University of Heidelberg)
Faulkner, Thomas (KITP Santa Barbara)
Gauntlett, Jerome (Imperial College London)
Gouteraux, Blaise (Nordita)
Haack, Michael (Ludwig-Maximilians University Munich)
Hartnoll, Sean (Stanford University)
Herzog, Christopher (Stony Brook University)
Hofman, Diego (Stanford University)
Hubeny, Veronika (University of Durham)
Huijse, Liza (Harvard University)
Iqbal, Nabil (KITP Santa Barbara)
Jensen, Kristan (University of Victoria)
Kaminski, Matthias (University of Washington)
Karch, Andreas (University of Washington)
Karczmarek, Joanna (University of British Columbia)
Kiritsis, Elias (APC, Paris and University of Crete)
Kovtun, Pavel (University of Victoria)
Leigh, Rob (University of Illinois at Urbana)
Natsuume, Makoto (KEK)
Petropoulos, Marios (Ecole Polytechnique)
Ramirez, David (Stanford University)
Rozali, Moshe (University of British Columbia)
Schalm, Koenrad (Leiden University)
Semenoff, Gordon (University of British Columbia)
Sin, Sang-Jin (Hanyang University)
Sonner, Julian (MIT)
Stang, Jared (University of British Columbia)
Van Raamsdonk, Mark (University of British Columbia)
Vegh, David (CERN)
Yarom, Amos (Technion)
Zaanen, Jan (Lorentz Institute University of Leiden)
Zeller, Hansjoerg (Max Planck Institute for Physics)

Probabilistic Approaches to Data Assimilation for Earth Systems February 17-22, 2013

Organizers:

Mark Buehner (Environment Canada)
Alexandre Chorin (UC, Berkeley)
Pierre Gauthier (Université de Québec à Montréal)

Kayo Ide (University of Maryland)
Robert Miller (Oregon State University)



Estimation and prediction of the state of a system by combination of observations and model output is a task that is common to many scientific fields. In the earth science community, it is referred to as “data assimilation.” A familiar example is numerical weather prediction used by the operational centers to issue forecasts for the atmospheric state, from daily weather to extreme events such as hurricane prediction. Data assimilation plays a key role in monitoring and predicting the future of physical systems. As the Planet Earth and the society face important issues such as climate change, mathematics can contribute significantly to advance data assimilation beyond the state-of-the-art. In this workshop, a group of prominent interdisciplinary specialists participated in cutting-edge research activities. This workshop was part of the Mathematics of Planet Earth 2013 (<http://www.mpe2013.org>), an international activity of the year 2013 that showcased the essential relevance of mathematics to planetary problems.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5139>

Participants:

Bergou, Elhoucine (CERFACS)
Bocquet, Marc (École des Ponts ParisTech)
Buehner, Mark (Environment Canada)
Cosme, Emmanuel (Université Joseph Fourier de Grenoble 1)
Dowd, Mike (Dalhousie University)
El Akkraoui, Amal (NASA / Science Systems and Applications Inc)
Gauthier, Pierre (Université de Québec à Montréal)
Houtekamer, Peter (Meteorological Service of Canada)
Ide, Kayo (University of Maryland)
Kalnay, Eugenia (University of Maryland)
Kleist, Daryl (NCEP)
Lermusiaux, Pierre (Massachusetts Institute of Technology)

Lorenc, Andrew (Met Office)
Malek-Madani, Reza (US Naval Academy)
Miller, Robert (Oregon State University)
Morzfeld, Matthias (Lawrence Berkeley National Laboratory)
Nichols, Nancy (University of Reading)
Restrepo, Juan (University of Arizona)
Spitz, Yvette (Oregon State University)
Todling, Ricardo (NASA Goddard Space Flight Center)
Weare, Jonathan (University of Chicago)
Weir, Brad (Oregon State University)
Whitaker, Jeffrey (National Oceanic and Atmospheric Administration)
Zhang, Fuqing (Penn State University)

Asymptotics of Large-Scale Interacting Networks

February 24 - March 1, 2013

Organizers:

Bruce Hajek (University of Illinois at Urbana-Champaign)

Peter Marbach (University of Toronto)
Sujay Sanghavi (University of Texas at Austin)



The workshop focused on large interacting networks, where agents infer and act on local viewpoints, with global consequences. Examples of interacting networks are biological networks where genes interact with each other, financial and economics networks where buyers and sellers interact, as well as social networks, and energy and communication networks. The workshop developed and refined mathematical techniques to address questions such as the following: would providing customers real time pricing and state information about the electrical power grid increase or decrease network stability? The workshop explored new approaches to better understand the characteristics and dynamics of large interacting networks. Of particular interest is the study of inference, control, and optimization algorithms for interacting networks, and their asymptotic analysis as the number of nodes in the network converges to infinity. The goal of the workshop was to act as a catalyst for new mathematical research directions and approaches in the emerging research area of asymptotic analysis of interacting networks.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5136>

Participants:

Abdullah, Mohammed (Imperial College London)
Anandkumar, Animashree (UC, Irvine)
Anantharam, Venkat (UC, Berkeley)
Baccelli, Francois (University of Texas at Austin)
Banerjee, Siddhartha (University of Texas at Austin)
Bresler, Guy (Massachusetts Institute of Technology)
Caramanis, Constantine (University of Texas at Austin)
Chaintreau, Augustin (Columbia University)
Como, Giacomo (Lund University)
Dimakis, Alex (University of Southern California)
Draief, Moez (Imperial College London)
Gamarnik, David (Massachusetts Institute of Technology)
Ganesh, Ayalvadi (University of Bristol)
Goel, Ashish (Stanford University)
Hajek, Bruce (University of Illinois at Urbana-Champaign)
Hou, I-Hong (Texas A & M)
Kanoria, Yashodhan (Microsoft Research New England)
Kudryashova, Natalia (University of Cambridge)
Lelarge, Marc (INRIA)

Liu, Zhenming (Princeton University)
Marbach, Peter (University of Toronto)
Mazumdar, Ravi (University of Waterloo)
Montanari, Andrea (Stanford University)
Nedich, Angelia (University of Illinois at Urbana-Champaign)
Ozdoglar, Asu (Massachusetts Institute of Technology)
Rao, K.S. Mallikarjuna (Indian Institute of Technology Bombay)
Sanghavi, Sujay (University of Texas at Austin)
Shin, Jinwoo (IBM Research and KAIST)
Simatos, Florian (Eindhoven University of Technology)
Singh, Aarti (Carnegie Mellon University)
Srikant, R. (University of Illinois at Urbana-Champaign)
Subramanian, Vijay (Northwestern University)
Sundaram, Shreyas (University of Waterloo)
Sunderesan, Rajesh (Indian Institute of Science)
Wierman, Adam (California Institute of Technology)
Xu, Jiaming (University of Illinois)
Zwart, Bert (CWI and VU University Amsterdam)

Applications of Iwasawa Algebras

March 3-8, 2013

Organizers:

Sujatha Ramdorai (University of British Columbia)
Peter Schneider (Mathematisches Institut Muenster)

Otmar Venjakob (Heidelberg University)



Mathematics abounds in the formal study of abstract structures which unexpectedly has links within different areas of Mathematics, and also to other areas outside mathematics. The study of Iwasawa algebras constitutes one such example of an area which has been discovered to have organic linkages with other arcane areas of mathematics like Number theory, study of groups, etc. This workshop brought together people working in these diverse areas to interact and lecture on the central role that Iwasawa algebras play in these different areas.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5032>

Participants:

Ardakov, Konstantin (Queen Mary, University of London)
Berger, Laurent (École Normale Supérieure de Lyon)
Bouganis, Thanasis (Universität Heidelberg)
Brakocovic, Miljan (McGill University)
Castella, Francesc (McGill University)
Chinburg, Ted (University of Pennsylvania)
Colmez, Pierre (Institut de Mathématiques de Jussieu)
Greenberg, Ralph (University of Washington)
Jha, Somnath (Osaka University)
Kakde, Mahesh (King's College London)
Kim, Dohyeong (POSTECH)
Kings, Guido (University Regensburg)
Kohlhaase, Jan (Universität Münster)
Lei, Antonio (McGill University)
Li, Zheng (University of British Columbia)
Loeffler, David (Warwick University)
Nakamura, Kentaro (Hokkaido University)
Nickel, Andreas (Bielefeld University)
Ochiai, Tadashi (Osaka University)
Popescu, Cristian D. (UC, San Diego)
Pottharst, Jonathan (Boston University)

Ramdorai, Sujatha (University of British Columbia)
Riedel, Andreas (Universität Heidelberg)
Ritter, Jurgen (University of Augsburg)
Schmidt, Tobias (Universität Münster)
Schmitt, Ulrich (Universität Heidelberg)
Schneider, Peter (Mathematisches Institut Muenster)
Sharifi, Romyar (University of Arizona)
Shekhar, Sudhanshu (Tata Institute of Fundamental Research)
Sprung, Florian (Brown University)
Vatsal, Vinayak (University of British Columbia)
Venjakob, Otmar (Heidelberg University)
Vigneras, Marie-France (Université Paris 7)
Wadsley, Simon (University of Cambridge)
Weiss, Al (University of Alberta)
Witte, Malte (Universität Heidelberg)
Wulkau, Matthias (Universität Münster)
Zábrádi, Gergely (Eötvös Loránd University)
Zerbes, Sarah (University of Exeter)

Interplay of Convex Geometry and Banach Space Theory

March 10-15, 2013

Organizers:

Grigoris Paouris (Texas A & M)
Carsten Schuett (Christian-Albrechts-Universitaet)

Elisabeth Werner (Case Western Reserve University)
Deping Ye (Memorial University of Newfoundland)



In the past, researchers have worked on various problems making use of invariants of both fields and many new techniques have been developed in each of the areas. This workshop took a comprehensive look at some of the major problems of the mentioned areas and focus on a few important ones.

They provided a forum for discussions with the objective of new collaborations and future research across the areas and in particular, gave a number of graduate students and postdocs the opportunity to interact with people from related fields and form new connections.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5060>

Participants:

Artstein-Avidan, Shiri (Tel Aviv University)
Barany, Imre (Renyi Institute)
Bernig, Andreas (University of Frankfurt)
Bezdek, Karoly (University of Calgary)
Bianchi, Gabriele (Università di Firenze)
Bisztriczky, Ted (University of Calgary)
Caglar, Umut (Case Western Reserve University)
Colesanti, Andrea (University of Florence)
Dann, Susanna (University of Missouri)
Giladi, Ohad (U Paris VI)
Gordon, Yehoram (Technion)
Koenig, Hermann (Universitaet Kiel)
Koldobsky, Alexander (University of Missouri)
Litvak, Alexander (University of Alberta)
Ludwig, Monika (Technische Universität München)
Meckes, Elizabeth (Case Western Reserve University)
Meckes, Mark (Case Western Reserve University)
Meyer, Mathieu (Université Paris-Est Marne-la-Vallée)
Milman, Vitali (Tel Aviv University)
Mueller, Paul (J. Kepler University Linz)
Paouris, Grigoris (Texas A & M)
Pivovarov, Peter (University of Missouri)

Prochno, Joscha (University of Alberta)
Reisner, Shlomo (University of Haifa)
Reitzner, Matthias (University of Osnabrueck)
Rotem, Liran (Tel-Aviv University)
Rudelson, Mark (University of Michigan, Ann Arbor)
Ryabogin, Dmitry (Kent State University)
Schechtman, Gideon (Weizmann Institute)
Schneider, Rolf (University of Freiburg)
Schuett, Carsten (Christian-Albrechts-Universitaet)
Spektor, Susanna (University of Alberta)
Stancu, Alina (Concordia University)
Tomczak-Jaegermann, Nicole (University of Alberta)
Webmendorfer, Manuel (Vienna University of Technology)
Werner, Elisabeth (Case Western Reserve University)
Xiao, Jie (Memorial University of Newfoundland)
Yaskin, Vladyslav (University of Alberta)
Yaskina, Maryna (University of Alberta and MacEwan University)
Ye, Deping (Memorial University of Newfoundland)
Zhou, Jiazuo (Southwest University)
Zvavitch, Artem (Kent State University)

CosmoStat2013: Statistical Challenges From Large Data Sets in Cosmology and Particle Physics

March 17-22, 2013

Organizers:

Ofer Lahav (University College London)
Roberto Trotta (Imperial College London)

Ben Wandelt (Sorbonne University)



The purpose of the conference was to bring together cosmologists, statisticians, experts in data mining and scientists from other fields, especially from particle physics (both phenomenologists and experimentalists), in order to provide a framework for a fruitful cross-fertilization of ideas across disciplines. The main objective was to foster the exchange of ideas and concepts both within the respective research directions as well as in between them. This involved critical assessment of algorithms and software packages developed in the 'other camp' which may not be known to workers outside the respective specialities.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5100>

Participants:

Anderes, Ethan (UC, Davis)
Arina, Chiara (University of Amsterdam)
Bassett, Bruce (AIMS and SAAO and UCT)
Cisewski, Jessi (Carnegie Mellon University)
Currie, Alastair (Imperial College London)
Dupuis, Grace (McGill University)
Edsjö, Joakim (Stockholm University)
Farmer, Benjamin (Monash University)
Feroz, Farhan (University of Cambridge)
Heavens, Alan (Imperial College London)
Hendry, Martin (University of Glasgow)
Ho, Shirley (Carnegie Mellon University)
Hobson, Michael (University of Cambridge)
Jimenez, Raul (ICREA and CERN)
Johannesson, Gudlaugur (University of Iceland)
Karpenka, Natallia (Stockholm University)
Kim, Alex (Lawrence Berkeley National Laboratory)
Koushiappas, Savvas (Brown University)

Kunz, Martin (University Geneva)
Lanusse, Francois (CEA Saclay)
Leonard, Adrienne (CEA Saclay)
Mandel, Kaisey (Imperial College London)
McEwen, Jason (University College London)
Pato, Miguel (Technische Universitaet Muenchen)
Ringeval, Christophe (CP3, Louvain University)
Ruiz de Austri, Roberto (Valencia University)
Schafer, Chad (Carnegie Mellon University)
Scott, Pat (McGill University)
Stein, Nathan (Harvard University)
Strege, Charlotte (Imperial College London)
Trotta, Roberto (Imperial College London)
Ullio, Piero (SISSA)
van Dyk, David (Imperial College London)
Vincent, Aaron (University of Valencia)
Wechsler, Risa (Stanford University)
Wehus, Ingunn Kathrine (JPL and Caltech)

Interactions of Gauge Theory With Contact and Symplectic Topology in Dimensions 3 and 4

March 24-29, 2013

Organizers:

Denis Auroux (UC, Berkeley)
Hans Boden (McMaster University)

Olivier Collin (Université du Québec à Montréal)
John Etnyre (Georgia Institute of Technology)



The proposed workshop is a follow-up to the BIRS workshops organized in March 2007 (Interactions of Geometry and Topology in Low Dimensions: BIRS 07w5033), March 2009 (Interactions of Geometry and Topology in dimensions 3 and 4: BIRS 09w5095), and March 2011 (Interactions between contact/symplectic topology and gauge theory in dimensions 3 and 4: BIRS 11w5085). It brought together a diverse group of mathematicians including experts working in 3- and 4-manifold topology and their invariants arising from gauge theory, contact and symplectic topology, but also placed special emphasis on including post-doctoral researchers and current Ph.D. students.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5037>

Participants:

Auckly, Dave (Kansas State University)
Auroux, Denis (UC, Berkeley)
Baldwin, John (Boston College)
Baykur, Refik Inanc (Max Planck Institute for Mathematics)
Bloom, Jonathan (MIT)
Boden, Hans (McMaster University)
Colin, Vincent (Université de Nantes)
Collin, Olivier (Université du Québec à Montréal)
Duncan, David (Rutgers University)
Ekholm, Tobias (Uppsala University)
Etnyre, John (Georgia Institute of Technology)
Fintushel, Ronald (Michigan State University)
Gay, David (University of Georgia)
Ghiggini, Paolo (CNRS and Université de Nantes)
Greene, Joshua (Boston College)
Harper, Eric (McMaster University)
Haydys, Andriy (Universität Bielefeld)
Hedden, Matthew (Michigan State University)
Herald, Chris (University of Nevada, Reno)
Honda, Ko (University Southern California)
Hutchings, Michael (University of California)

Jabuka, Stanislav (University of Nevada, Reno)
Kutluhan, Cagatay (Harvard University)
Lecuona, Ana (Université Aix-Marseille)
Lee, Yi-Jen (Purdue University)
Licata, Joan (Australian National University)
Lisca, Paolo (University of Pisa)
Mark, Thomas (University of Virginia)
Matic, Gordana (University of Georgia)
Ng, Lenny (Duke University)
Petkova, Ina (Rice University)
Plamenevskaya, Olga (State University of New York at Stony Brook)
Ruberman, Daniel (Brandeis University)
Saveliev, Nikolai (University of Miami)
Stipsicz, Andras (Hungarian Academy of Sciences)
Strle, Saso (University of Ljubljana)
Tosun, Bulent (Université du Québec à Montréal)
Vidussi, Stefano (UC, Riverside)
Watson, Liam (UC, Los Angeles)
Wehrheim, Katrin (UC, Berkeley)
Zarev, Rumen (UC, Berkeley)

Partial Differential Equations in the Social and Life Science: Emergent Challenges in Modeling, Analysis, and Computations

March 31 - April 5, 2013

Organizers:

Rustum Choksi (McGill University)
Maria Del Mar González (Universita' Politecnica de Barcelona)

Maria Guldani (George Washington University)
Maria Elena Schonbek (UC, Santa Cruz)



The year 2013 was deemed a special year: Mathematics of Planet Earth 2013. Partial differential equations have historically played a major role in the modeling, analysis and computation of complex systems surrounding many aspects of planet earth. This workshop focussed on the challenges and advancements in mathematical modeling — with partial differential equations — for applications in the social and life sciences such as opinion formations, population dynamics, traffic patterns, behavioral analysis in financial markets, environmental economics, neuroscience and crime spots detection.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5106>

Participants:

Bertozzi, Andrea (UC, Los Angeles)
Caceres, Maria José (Universidad de Granada)
Calder, Jeff (University of Michigan)
Carrillo, Jose Antonio (Imperial College London)
Choksi, Rustum (McGill University)
Di Francesco, Marco (University of Bath)
Du, Qiang (Pennsylvania State University)
Düring, Bertram (University of Sussex)
Gomes, Diogo (Instituto Superior Tecnico)
González, Maria Del Mar (Universita' Politecnica de Barcelona)
Haskovec, Jan (King Abdullah University of Science and Technology)
Huang, Yanghong (Imperial College London)
Illner, Reinhard (University of Victoria)
Jabin, Pierre-Emmanuel (University of Maryland)
Lorz, Alexander (Universite Pierre et Marie Curie)

Martin, Stephan (Imperial College London)
Matthes, Daniel (Technische Universitaet Muenchen)
Nave, Jean-Christophe (McGill University)
Osting, Braxton (UC, Los Angeles)
Pareschi, Lorenzo (Universita di Ferrara)
Powers, Lisa (McGill University)
Rodriguez, Nancy (Stanford University)
Schonbek, Maria Elena (UC, Santa Cruz)
Sola-Morales, Joan (Universitat Politecnica de Catalunya)
Srinivasan, Ravi (University of Texas at Austin)
Tadmor, Eitan (University of Maryland)
Tcheng, Alexandra (McGill University)
Tsai, Richard (University of Texas at Austin)
van Gennip, Yves (UC, Los Angeles)
Vasseur, Alexis (University of Texas at Austin)
Yao, Yao (University of Wisconsin Madison)

Mapping Class Groups and Categorification

April 7-12, 2013

Organizers:

Jason Behrstock (Lehman College, CUNY)
Anthony Licata (Institute for Advanced Study)

Robert Lipshitz (Columbia University)



The goal of this workshop was to bring together researchers in two related fields -- geometric group theory and categorification -- to improve each group's understanding of the tools and techniques of the other. Both fields are rapidly developing, and the relations between them are just starting to become apparent.

This conference aimed to facilitate the flow of knowledge between these two subjects. In particular, two of the goals of this conference were to make those working on categorification aware of the main questions of current interest in the study of mapping class groups, and for researchers on mapping class groups to learn what kinds of tools categorification makes available.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5108>

Participants:

Behrstock, Jason (Lehman College, CUNY)
Beliakova, Anna (University of Zurich)
Bigelow, Stephen (UC, Santa Barbara)
Brandenbursky, Michael (Vanderbilt)
Cautis, Sabin (Columbia University)
Clarkson, Corrin (Columbia University)
Cotton-Clay, Andrew (Harvard University)
Dunfield, Nathan (University of Illinois, Urbana-Champaign)
Elias, Benjamin (Massachusetts Institute of Technology)
Felshtyn, Alexander (University of Szczecin)
Freedman, Michael (Microsoft Research)
Gilmore, Allison (UC, Los Angeles)
Gonzalez-Meneses, Juan (University of Seville)
Grigsby, J. Elisenda (Boston College)
Hanselman, Jonathan (Columbia University)
Hendricks, Kristen (Columbia University)
Hom, Jennifer (Columbia University)

Koberda, Thomas (Yale University)
Korkmaz, Mustafa (Middle East Technical University)
Krushkal, Slava (University of Virginia)
Lauda, Aaron (University of Southern California)
Leininger, Chris (University of Illinois, Urbana-Champaign)
Licata, Anthony (Institute for Advanced Study)
Mangahas, Johanna (Brown University)
Margalit, Dan (Georgia Institute of Technology)
Matic, Gordana (University of Georgia)
Perutz, Tim (University of Texas at Austin)
Schleimer, Saul (University of Warwick)
Sivek, Steven (Harvard University)
Sultan, Harold (Brandeis University)
Susse, Tim (City University of New York)
Thurston, Dylan (Indiana University)
Tian, Yin (University of Southern California)
Watson, Liam (UC, Los Angeles)

Arithmetic Groups

April 14-19, 2013

Organizers:

Kai-Uwe Bux (Universität Bielefeld)
Dave Morris (University of Lethbridge)

Gopal Prasad (University of Michigan)
Andrei Rapinchuk (University of Virginia)



Group theory is the mathematical study of symmetric structures (such as crystals) and repeating patterns (such as an infinitely large checkerboard). Arithmetic groups are special groups whose elements are matrices with integral entries. They play a crucial role in many areas of mathematics, including algebra and various parts of number theory (e.g., the theory of automorphic forms). This notion has a long history, with roots in the 200-year-old work of Gauss on integral quadratic forms. In recent years, new applications of the theory have emerged in algebraic and differential geometry, Lie groups, and combinatorics. This workshop brought together experts in the subject of arithmetic groups, in order to advance the understanding of the groups themselves, and to further develop the important connections to other areas of mathematics.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5019>

Participants:

Abels, Herbert (Bielefeld University)
Abramenko, Peter (University of Virginia)
Belolipetsky, Mikhail (IMPA)
Bux, Kai-Uwe (Universität Bielefeld)
Chernousov, Vladimir (University of Alberta)
Chinburg, Ted (University of Pennsylvania)
Conrad, Brian (Stanford University)
Emery, Vincent (Stanford University)
Ji, Lizhen (University of Michigan)
Kassabov, Martin (Cornell University)
Kelly, Brendan (University of Utah)
Kionke, Steffen (Max-Planck Institute for Mathematics)
Klopsch, Benjamin (University of London)
Köhl, Ralf (Universität Gießen)
Lifschitz, Lucy (University of Oklahoma)
Morris, Dave (University of Lethbridge)
Niesdroy, Henning (Universität Bielefeld)
Prasad, Gopal (University of Michigan)

Raghunathan, Madabusi S. (Indian Institute of Technology)
Rajan, Conjeeveram S (Tata Institute of Fundamental Research)
Rapinchuk, Andrei (University of Virginia)
Rapinchuk, Igor (Yale University)
Reid, Alan (University of Texas at Austin)
Remy, Bertrand (University of Lyon)
Salehi Golsefidy, Alireza (UC, San Diego)
Schwandt, Marco (University of Bielefeld)
Schwartz, Joshua (University of Virginia)
Stover, Matthew (University of Michigan)
Sury, B. (Indian Statistical Institute)
Venkataramana, Tyakal (Tata Institute of Fundamental Research)
Voll, Christopher (University of Bielefeld)
Witzel, Stefan (University of Muenster)
Wortman, Kevin (University of Utah)
Zaleskii, Pavel (University of Brasilia)

Whitney Problems

April 21-26, 2013

Organizers:

Alex Brudnyi (University of Calgary)
Charles Fefferman (Princeton University)

Pavel Shvartsman (Technion)
Nahum Zobin (College of William & Mary)



The objective of the program was to bring together an international group of experts in the areas of function theory and functional and geometric analysis to report on and discuss recent progress and open problems in the area of Whitney type problems and thus foster interaction and collaboration between researchers in these fields. A number of current and recent developments made such a program useful and timely.

The problems discussed were motivated by boundary value problems for partial differential equations and by classical trace and extension theorems characterizing traces of spaces of generalized smoothness (e.g., Sobolev, Besov, etc.) to smooth submanifolds of a Euclidean space.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5005>

Participants:

Akhunov, Timur (University of Calgary)
Bos, Len (University of Verona)
Brudnyi, Alex (University of Calgary)
Fefferman, Charles (Princeton University)
Hurri-Syrjanen, Ritva (University of Helsinki)
Israel, Arie (New York University)
Kinzebulatov, Damir (The Fields Institute)
LeGruyer, Erwan (Institut National des Sciences Appliquées de Rennes)

Luli, Garving (Yale University)
Nicoara, Andrea (University of Pennsylvania)
Shvartsman, Pavel (Technion)
Uriarte-Tuero, Ignacio (Michigan State University)
Yomdin, Yosef (The Weizmann Institute of Science)
Zobin, Nahum (College of William & Mary)

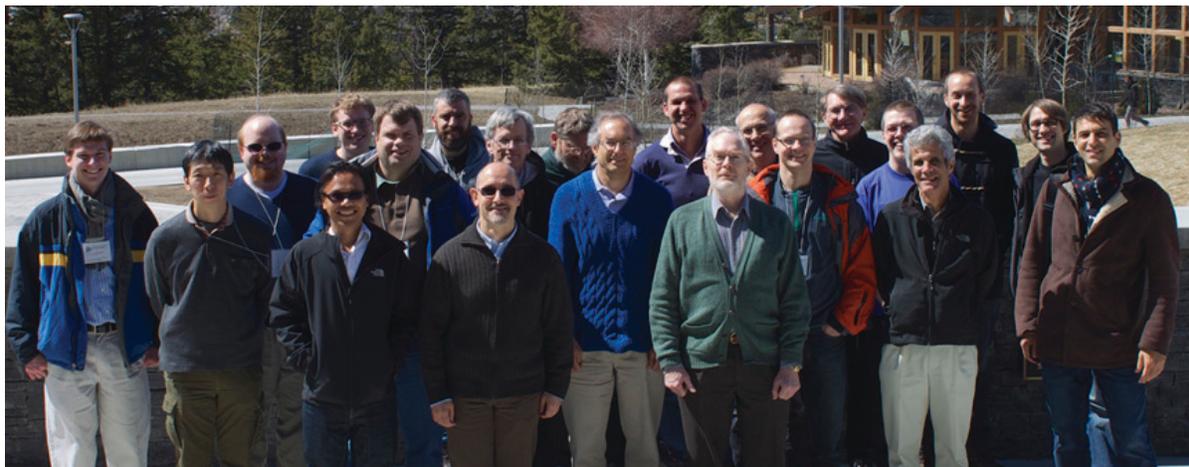
Graph Algebras: Bridges Between Graph C*-algebras and Leavitt Path Algebra

April 21-26, 2013

Organizers:

Gene Abrams (University of Colorado)
Jason Bell (Simon Fraser University)
Soren Eilers (University of Copenhagen)

George Elliott (University of Toronto)
Marcelo Laca (University of Victoria)
Mark Tomforde (University of Houston)



One of the most basic of structures studied by mathematicians is known in mathematical parlance as a “directed graph.” A directed graph is really nothing more than a collection of locations (the “vertices” of the graph), and arrows (the “edges” of the graph) which point from one vertex to another. Directed graphs arise naturally in communications systems, physics, computer science, and a host of other fields. Directed graphs have been used as the foundation upon which numerous additional mathematical structures have been constructed. Two of these structures, the “graph C*-algebras” studied in the subject of Analysis and the “Leavitt path algebras” studied in the subject of Algebra, have an interesting, intertwined history and have been the focus of numerous mathematicians around the world.

There are many striking similarities between these two types of algebras. However, the underlying reason for such similarities remains a mystery. Mathematicians from both the Analysis and Algebra worlds met at BIRS in order to try to unravel this mystery, with the ultimate goal of finding a Rosetta Stone that would allow for the translation of results from each class of algebras to the other.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5049>

Participants:

Abrams, Gene (University of Colorado)
Ara, Pere (Universitat Autònoma de Barcelona)
Bentmann, Rasmus (University of Copenhagen)
Boyle, Mike (University of Maryland)
Brenken, Berndt (University of Calgary)
Carlsen, Toke (Norwegian University of Science and Technology)
Elliott, George (University of Toronto)
Hazrat, Roozbeh (University of Western Sydney)
Katsura, Takeshi (Keio University)
Kumjian, Alex (University of Nevada)
Laca, Marcelo (University of Victoria)
Ortega, Eduard (University of Trondheim (NTNU))

Pardo, Enrique (University of Cadiz)
Perera, Francesc (Universitat Autònoma de Barcelona)
Phillips, N. Christopher (University of Oregon)
Restorff, Gunnar (University of Faroe Islands)
Ruiz, Efrén (University of Hawaii Hilo)
Sims, Aidan (University of Wollongong)
Smith, Chris (Google)
Sorensen, Adam (University of Wollongong)
Tomforde, Mark (University of Houston)
Webster, Sam (University of Wollongong)
Whalen, Tristan (University of Houston)

Mathematical Methods in Quantum Molecular Dynamics

April 28 - May 3, 2013

Organizers:

Tucker Carrington (Queen's University) **George Hagedorn** (Virginia Polytechnic Institute and State University)



The motion of atoms in molecules and during reactions is governed by quantum mechanical equations that are easy to write down but extremely difficult to solve. The fundamental mathematical problems that prevent their solution are preventing progress in the field of molecular quantum dynamics. The workshop on Quantum Molecular Dynamics brought together chemists, physicists and mathematicians working in this field. Communication between these groups of scientists has been poor and the workshop provides an opportunity for all three fields benefit and create new lines of communication. Mathematicians will learn of progress made and problems faced by chemists and physicists working in the area. Chemists and physicists will learn of techniques mathematicians have developed for addressing the difficulties they face in finding approximate solutions to the equations.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5018>

Participants:

Avilla, Gustavo (Queen's University)
Betz, Volker (TU Darmstadt)
Bourquin, Raoul (ETH Zurich)
Bowman, Joel (Emory University)
Brown, Alex (University of Alberta)
Burghardt, Irene (University of Frankfurt)
Carrington, Tucker (Queen's University)
Christiansen, Ove (Aarhus University)
Fermanian Kammerer, Clotilde (Universite Paris Est)
Gauckler, Ludwig (TU Berlin)
Goddard, Benjamin (Imperial College London)
Griebel, Michael (Universitaet Bonn)
Guo, Hua (University of New Mexico)
Hagedorn, George (Virginia Polytechnic Institute and State University)
Jefferis, Leland (University of Wisconsin - Madison)
Jennings, Brian (Westfield State University)
Jin, Shi (Shanghai Jiao Tong University and University of Wisconsin)
Joye, Alain (Université Grenoble 1)
Kapral, Raymond (University of Toronto)
Lasser, Caroline (Technische Universität München)
Lauvergnat, David (University of Paris-Sud)
Leclerc, Arnaud (Queen's University)
Lubich, Christian (Universitaet Tuebingen)
Manthe, Uwe (Bielefeld University)
Manzhos, Sergei (National University of Singapore)
Martinez, Todd (Stanford University)
Mccoy, Anne (Ohio State University)
Meyer, Hans-Dieter (University of Heidelberg)
Miller, William H. (UC, Berkeley)
Panati, Gianluca (Sapienza Università di Roma)
Poirier, Bill (Texas Tech University)
Roy, Pierre-Nicholas (University of Waterloo)
Schneider, Reinhold (Technische Universität Berlin)
Shalashilin, Dmitry (University of Leeds)
Szalor, Viktor (Hungarian Academy of Sciences)
Teufel, Stefan (Universitaet Tuebingen)
Tremblay, Jean Christophe (University of Potsdam)
Valeev, Edward (Virginia Tech)
Wang, Haobin (New Mexico State University)
Wang, Yimin (Emory University)
Worth, Graham (University of Birmingham)

The Art of Iterating Rational Functions over Finite Fields

May 5-10, 2013

Organizers:

Nigel Boston (University of Wisconsin)
Alina Ostafe (Macquarie University)

Igor Shparlinski (Macquarie University)
Michael Zieve (University of Michigan)



The field of complex dynamical systems generated by iteration of polynomials and rational functions is a classical area of mathematics with a rich history and a wide variety of results. Recently, there has been substantial interest in arithmetical dynamical systems (ADS), meaning the iteration of rational functions over fields of number-theoretic interest. This workshop studied dynamical systems over finite fields, fertile ground for potential applications to many different areas of modern cryptography, coding theory, Monte Carlo simulations, physics, biology, and other areas, as well as for the development of algorithmic and computer-oriented approaches.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5141>

Participants:

Ahmadi, Omran (Institute for Research in Fundamental Sciences)
Anashin, Vladimir (Moscow State University)
Armana, Cécile (Université de Franche-Comté)
Baake, Michael (University of Bielefeld)
Bach, Eric (University of Wisconsin-Madison)
Bedford, Eric (Stony Brook University)
Benedetto, Robert (Amherst College)
Boston, Nigel (University of Wisconsin)
Bridy, Andrew (University of Wisconsin)
Chang, Mei-Chu (UC, Riverside)
Elkies, Noam (Harvard University)
Fuchs, Clemens (University of Salzburg)
Giesbrecht, Mark (University of Waterloo)
Gomez Perez, Domingo (University of Cantabria)
Gutierrez, Jaime (University of Cantabria)
Hone, Andrew (University of Kent)
Hutz, Benjamin (Florida Institute of Technology)
Ingram, Patrick (Colorado State University)
Jones, Rafe (Carleton College)
Kurlberg, Par (KTH Royal Institute of Technology)

Laubenbacher, Reinhard (Virginia Polytechnic Inst.)
Levy, Alon (University of British Columbia)
Manes, Michelle (University of Hawaii at Manoa)
Maubach, Stefan (Jacobs University)
Neumaerker, Natascha (Silesian University of Opava)
Ostafe, Alina (Macquarie University)
Panario, Daniel (Carleton University)
Roberts, John (University of New South Wales)
Rosenthal, Joachim (University of Zurich)
Scherr, Zachary (University of Michigan)
Schmutz, Eric (Drexel University)
Shparlinski, Igor (Macquarie University)
Towsley, Adam (CUNY Graduate Center)
Ugolini, Simone (Free University of Bozen)
Vivaldi, Franco (Queen Mary University of London)
Voloch, Jose Felipe (University of Texas at Austin)
von zur Gathen, Joachim (B-IT, University of Bonn)
Winterhof, Arne (Austrian Academy of Sciences)
Ziegler, Konstantin (B-IT, University of Bonn)
Zieve, Michael (University of Michigan)

Impact of Climate Change on Biological Invasions and Population Distributions

May 12-17, 2013

Organizers:

Henri Berestycki (L'Ecole des Hautes Etudes en Sciences Sociales Paris)

Alan Hastings (UC, Davis)

Mark Lewis (University of Alberta)

Péter Molnár (Princeton University)



Our globe is experiencing rapid climate change. Ecologists and environmental biologists now focus much of their research effort on understanding current changes and trying to predict the impacts of future changes. Indeed, this has spawned new disciplines within ecology and environmental biology such as global change biology and conservation biology. What does mathematics have to offer these subjects? What new quantitative tools are needed? This workshop aimed to develop and apply the mathematics of dynamical systems to understand ecological systems under climate change. The mathematical models were expressed as nonautonomous dynamical systems with spatial and stochastic components. The meeting provided a synergistic research environment, where researchers that do not usually interact could come together and experience cross-disciplinary opportunities for developing and applying methods of dynamical systems to population dynamics under environmental change.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5095>

Participants:

Berestycki, Henri (L'Ecole des Hautes Etudes en Sciences Sociales Paris)

Bonsall, Michael (University of Oxford)

Cantrell, Stephen (University of Miami)

Cobbold, Christina (University of Glasgow)

Cosner, Chris (University of Miami)

Cuddington, Kim (Waterloo)

Desvillettes, Laurent (Ecole Normale Supérieure de Cachan)

Diekmann, Odo (Universiteit Utrecht)

Dooley, Claire (University of Oxford)

Fagan, William (University of Maryland)

Garnier, Jimmy (INRA Avignon)

Guckenheimer, John (Cornell University)

Hamel, Francois (Université d'Aix-Marseille)

Hastings, Alan (UC, Davis)

Hurford, Amy (Memorial University of Newfoundland)

Jenouvrier, Stephanie (Woods Hole Oceanographic Institute)

Kiselev, Alexander (University of Wisconsin, Madison)

Lewis, Mark (University of Alberta)

Long, Andy (Northern Kentucky University)

23 **Lou, Yuan** (Ohio State University)

Melbourne, Brett (University of Colorado)

Meron, Ehud (Ben Gurion University of the Negev)

Miller, Judith (Georgetown University)

Moberg, Emily (Woods Hole Oceanographic Institution and MIT)

Molnár, Péter (Princeton University)

Moorcroft, Paul (Harvard University)

Neubert, Michael (Woods Hole Oceanographic Institution)

Petrovskii, Sergei (University of Leicester)

Record, Nicholas (Bowdoin College)

Roquejoffre, Jean-Michel (Université Paul Sabatier Toulouse III)

Roques, Lionel (INRA)

Rossi, Luca (Università di Padova)

Ryzhik, Lenya (Stanford University)

Tyson, Rebecca (University of British Columbia, Okanagan)

Wang, Hao (University of Alberta)

Watmough, James (University of New Brunswick)

Zeeman, Mary Lou (Bowdoin College)

Zhu, Huaiping (York University (Canada))

Zou, Xingfu (University of Western Ontario)

Non-Gaussian Multivariate Statistical Models and their Applications

May 19-24, 2013

Organizers:

Narayanaswamy Balakrishnan (McMaster University)
Chris Field (Dalhousie University)

Marc Genton (King Abdullah University of Science and Technology)
Harry Joe (University of British Columbia)



This workshop intended to study extensions of classical Gaussian-based multivariate statistical models to non-Gaussian ones that are more realistic to solve important problems arising from many applications, including areas such as economics, finance, management science, oceanography, climatology, environmetrics, forestry, engineering, renewable energies, image processing, astronomy, clinical trials, and biomedical science.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5146>

Participants:

Aas, Kjersti (Norwegian Computing Center)
Adcock, Chris (Sheffield University)
Arellano-Valle, Reinaldo B. (Pontificia Católica University)
Arnold, Barry (University of California Riverside)
Azzalini, Adelchi (Università di Padova)
Balakrishnan, Narayanaswamy (McMaster University)
Branco, Marcia (University of Sao Paulo)
Brechmann, Eike (Technische Universität Muenchen)
Cooke, Roger (Resources for the Future)
Czado, Claudia (Technical University of Muenich)
Dey, Dipak (University of Connecticut)
Field, Chris (Dalhousie University)
Fullsack, Philippe (Dalhousie University)
Genest, Christian (McGill University)
Genton, Marc (King Abdullah University of Science and Technology)
Giorgi, Emanuele (University of Padova)
Hua, Lei (Northern Illinois University)
Jiménez-Gamero, María Dolores (University of Sevilla)
Joe, Harry (University of British Columbia)
Jones, Chris (Open University)
Kim, Hyong-Moon (Konkuk University)
Kojadinovic, Ivan (Université de Pau et des Pays de l'Adour)

Krupskii, Pavel (University of British Columbia)
Kurowicka, Dorota (Nanyang Technological University)
Li, Haijun (Washington State University)
Liseo, Brunero (University La Sapienza of Rome)
Loschi, Rosangela (Universidade Federal de Minas Gerais)
McNeil, Alexander (Heriot-Watt University)
Nathoo, Farouk (University of Victoria)
Naveau, Philippe (Centre National de la Recherche Scientifique, Laboratoire des Sciences du Climat et l'Environnement)
Neslehova, Johanna (McGill University)
Nikoloulopoulos, Aristidis K. (University of East Anglia)
Pewsey, Arthur (Universidad de Extremadura)
Regoli, Giuliana (University of Perugia)
Rémillard, Bruno (HEC Montréal)
Scarpa, Bruno (University of Padova)
Sun, Ying (University of Chicago)
Tan, Tao (McMaster University)
Valdez, Emiliano (University of Connecticut)
Volgushev, Stanislav (Ruhr-Universität Bochum)
Yoshida, Toshinao (Bank of Japan and Institute of Statistical Mathematics)
Zhu, Xiaojun (McMaster University)

Mathematical Tools for Evolutionary Systems Biology

May 26-31, 2013

Organizers:

Ryan Gutenkunst (University of Arizona)
Laurence Loewe (University of Wisconsin-Madison)

Peter S. Swain (SynthSys, University of Edinburgh)



This workshop aimed to bring together researchers from three domains: mathematics, systems biology, and evolutionary biology. Both systems biology and evolutionary biology constantly challenge mathematics because of the complexity of the systems they study. By bringing biologists from these two fields together with mathematicians, we plan to initiate the development of new mathematics to bring the two disciplines together and therefore strengthen the application of theory to biology.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5080>

Participants:

Allen, Rosalind (University of Edinburgh)
Anderson, David (University of Wisconsin-Madison)
Ben-Zion, Ishay (Tel Aviv University)
Bergman, Aviv (Albert Einstein College of Medicine)
Borenstein, Elhanan (University of Washington)
Bruggeman, Frank (Vrije Universiteit)
Buchler, Nicolas (Duke University)
Chandra, Fiona (California Institute of Technology)
Chao, Lin (UC, San Diego)
Charlebois, Daniel (Ottawa Institute of Systems Biology)
Clark, Andrew (Cornell University)
Crombach, Anton (Centre for Genomic Regulation and Universitat UPF Barcelona)
Day, Troy (Queen's University)
Ehlert, Kurt (University of Wisconsin-Madison)
Emberly, Eldon (Simon Fraser University)
Faeder, James (University of Pittsburgh)
Ferris, Michael C. (University of Wisconsin)
Fisher, Daniel (Stanford University)
Gavrilets, Sergey (University of Tennessee)
Geiler-Samerotte, Kerry (New York University)
Gomez-Schiavon, Mariana (Duke University)

Gutenkunst, Ryan (University of Arizona)
Joyce, Paul (University of Idaho)
Laessig, Michael (University of Cologne)
Liberles, David (University of Wyoming)
Loewe, Laurence (University of Wisconsin-Madison)
MacCarthy, Tom (State University of New York)
Mannakee, Brian (University of Arizona)
Masel, Joanna (University of Arizona)
Moses, Alan (University of Toronto)
Nemenman, Ilya (Emory University)
Petzold, Linda (UC, Santa Barbara)
Rifkin, Scott (UC, San Diego)
Savageau, Michael (UC, Davis)
Steinacher, Arno (University of Exeter)
Swain, Peter S. (SynthSys, University of Edinburgh)
Tans, Sander (AMOLF)
van Doorn, Sander (University of Groningen)
van Nimwegen, Erik (University of Basel)
Wahl, Lindi (Western University)
Xavier, Joao (Sloan Kettering)
Zhang, Jianzhi (University of Michigan)

Refined Invariants in Geometry, Topology and String Theory

June 2-7, 2013

Organizers:

Jim Bryan (University of British Columbia)
Duiliu Emanuel Diaconescu (University of Alberta)

Tamás Hausel (EPF Lausanne)
Balazs Szendroi (Oxford University)



In the physics of string theory, the universe is a ten dimensional space. While four of the dimensions comprise the usual notions of space and time, the remaining six are curled up into tiny complicated geometric spaces called Calabi-Yau threefolds. Understanding the geometry of Calabi-Yau threefolds is central to both algebraic geometry and physics. The surprising link between the mathematics and physics has led to a flurry of recent advances in both fields. This workshop brought together both mathematicians and physicists to explore an even more recent discovery: that the correspondence between the mathematical and physical counts can be "refined" to even subtler counts on both the geometric and physical sides. These refinements have led to several amazing conjectures in a variety of fields, ranging from the topology of knots to integrable systems.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5134>

Participants:

Behrend, Kai (University of British Columbia)
Bouchard, Vincent (University of Alberta)
Bryan, Jim (University of British Columbia)
Bussi, Vittoria (University of Oxford)
Davison, Ben (Université Paris 7)
de Cataldo, Mark (Stony Brook University)
Diaconescu, Duiliu Emanuel (University of Alberta)
Fantechi, Barbara (Scuola Internazionale Superiore di Studi Avanzati)
Getzler, Ezra (Northwestern University)
Gholampour, Amin (University of Maryland)
Hausel, Tamás (EPF Lausanne)
Hollands, Lotte (California Institute of Technology)
Holman, Brett (University of Alberta)
Hua, Zheng (Kansas State University)
Joyce, Dominic (University of Oxford)
Karp, Dagan (Harvey Mudd College)
Katz, Sheldon (University of Illinois)

Letellier, Emmanuel (University of Caen)
Meinhardt, Sven (University of Bonn)
Mendez-Diez, Stefan (University of Alberta)
Migliorini, Luca (Università di Bologna)
Morrison, Andrew (ETH Zurich)
Nagao, Kentaro (Nagoya University Japan)
Oblomkov, Alexei (University of Massachusetts)
Okounkov, Andrei (Columbia University)
Preygel, Anatoly (UC, Berkeley)
Ronagh, Pooya (University of British Columbia)
Ross, Dusty (Colorado State University)
Rupel, Dylan (Northeastern University)
Shende, Vivek (Massachusetts Institute of Technology)
Sorkin, Adam (UC, Davis)
Szendroi, Balazs (Oxford University)
Szenes, Andras (University of Geneva)
Young, Ben (University of Oregon)

Nonlinear Conservation Laws and Related Models

June 9-14, 2013

Organizers:

Sylvie Benzoni-Gavage (University of Lyon)
Gui-Qiang Chen (University of Oxford)
Walter Craig (McMaster University)

Constantine Dafermos (Brown University)
Konstantina Trivisa (University of Maryland)



The goal of the workshop was to bring together experts in the theoretical and numerical aspects of nonlinear conservation laws and related partial differential equations, to take part in the examination of emerging problems, exchanging ideas in a structured and focused environment. Furthermore, the workshop offered an opportunity to bring into focus other mathematical questions that are able to be addressed by the methods developed by the conservation laws community.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5061>

Participants:

Audiard, Corentin (Paris 6 (France))
Benzoni-Gavage, Sylvie (University of Lyon)
Canic, Suncica (University of Houston)
Chen, Gui-Qiang (University of Oxford)
Cheng, Bin (University of Surrey)
Christoforou, Cleopatra (University of Cyprus)
Coclite, Giuseppe Maria (University of Bari)
Coulombel, Jean-Francois (CNRS (Nantes))
Craig, Walter (McMaster University)
Crippa, Gianluca (University of Basel)
Dafermos, Constantine (Brown University)
Donatelli, Donatella (University of L'Aquila)
Feireisl, Eduard (Academy of Sciences of the Czech Republic)
Feldman, Mikhail (University of Wisconsin)
Gustafson, Stephen (University of British Columbia)
Ha, Seung Yeal (Seoul National University)
Holden, Helge (NTNU Trondheim)

Junca, Stephane (Université de Nice Sophia-Antipolis)
Keyfitz, Barbara (Ohio State University)
Kim, Eun Heui (California State University at Long Beach)
Klingenberg, Christian (Wurzburg University)
Liu, Tai-Ping (Academia Sinica)
Marson, Andrea (University of Padova)
McCann, Robert (University of Toronto)
Noble, Pascal (University of Lyon 1)
Rousset, Frederic (Rennes 1 (France))
Serre, Denis (Ecole Normale Supérieure-Lyon (France))
Slemrod, Marshall (University of Wisconsin)
Sun, Weiran (SFU)
Tadmor, Eitan (University of Maryland)
Torres, Monica (Purdue University)
Trivisa, Konstantina (University of Maryland)
Tsai, Tai-Peng (University of British Columbia)
Wiedemann, Emil (University of British Columbia)

Rules of Protein-DNA Recognition: Computational and Experimental Advances

June 16-21, 2013

Organizers:

Alexandre Morozov (Rutgers University)

Gary Stormo (Washington University, St. Louis)



The workshop focussed on recent progress in understanding structural and energetic mechanisms that enable DNA-binding proteins (such as transcription factors) to bind their cognate genomic sites with high affinity and specificity. Its main purpose was to bring together researchers with diverse approaches to studying protein-DNA recognition, not just experimental versus computational but also different approaches in each of those areas. The goal was to get a better understanding of the data about specificity and how it could be modeled and predicted, with one goal being to improve the methods for the design of proteins with novel DNA-binding interfaces. Advances in understanding the rules of protein-DNA recognition will lead to better understanding of such fundamental biological processes as DNA replication and transcription, with numerous future applications in biotechnology and medicine. Recent breakthroughs in developing high-throughput experimental techniques make development of novel mathematical and computational techniques for analyzing protein-DNA interaction data a high priority.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5042>

Participants:

Ansari, Anjum (University of Illinois)
Ansari, Aseem (University of Wisconsin-Madison)
Bhimsaria, Devesh (University of Wisconsin)
Bondos, Sarah (Texas A&M University)
Bradley, Phil (Fred Hutchinson Cancer Research Center)
Bulyk, Martha (Brigham & Women's Hospital and Harvard Medical School)
Bussemaker, Harmen (Columbia University)
Camacho, Carlos (University of Pittsburgh)
Dror, Iris (University of Southern California)
Gordan, Raluca (Duke University)
Haran, Tali (Technion)
Hughes, Tim (University of Toronto)
Kaptein, Robert (Utrecht University)
Koudelka, Gerald (University at Buffalo (SUNY))
Lavery, Richard (Bases Moléculaires et Structurales des Systemes Infectieux)
Lukatsky, David (Ben-Gurion University of the Negev)
Mandel-Gutfreund, Yael (Technion- Israel Institute of Technology)

Mann, Richard (Columbia University)
Mitchell, Julie (University of Wisconsin - Madison)
Morozov, Alexandre (Rutgers University)
Morris, Quaid (University of Toronto)
Noyes, Marcus (Princeton University)
Reich, Norbert (UC, Santa Barbara)
Rice, Phoebe (University of Chicago)
Riley, Todd (Columbia University)
Rohs, Remo (University of Southern California)
Samorodnitsky, Dan (University of Buffalo)
Sarai, Akinori (Kyushu Institute of Technology)
Singh, Mona (Princeton University)
Slattery, Matthew (University of Chicago)
Stormo, Gary (Washington University in St. Louis School of Medicine)
Taipale, Jussi (Karolinska Institutet)
Wasserman, Wyeth (University of British Columbia)
Wolfe, Scot (UMass Medical School)

Water Waves: Computational Approaches for Complex Problems

June 30 - July 5, 2013

Organizers:

Walter Craig (McMaster University)

Nathan Kutz (University of Washington)

Paul Milewski (University of Bath)

Andre Nachbin (Instituto Nacional de Matematica Pura e Aplicada)



The understanding of water waves is a remarkably complex, broad and vital problem affecting weather, climate and human endeavour. The understanding and accurate computation of water waves have broad human impact. Examples are the accurate interpretation of satellite remote sensing data of the wind conditions over the ocean, the understanding of conditions that generate giant or freak waves, destructive to shipping and the better prediction of tsunamis which, as we know, can cause devastation on a continental scale. Water waves and wave breaking play an important geophysical role in the physical and chemical interaction between the atmosphere and ocean, ultimately affecting the global climate. The workshop aimed to advance the state-of-the-art of water wave computation and thus have direct benefits in these areas.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5069>

Participants:

Ablowitz, Mark (University of Colorado, Boulder)

Akers, Benjamin (Air Force Institute of Technology)

Akylas, Triantaphyllos R. (Massachusetts Institute of Technology)

Ambrose, David (Drexel University)

Athanassoulis, Gerassimos (National Technical University of Athens)

Barros, Ricardo (Instituto Nacional de Matemática Pura e Aplicada)

Beale, James Thomas (Duke University)

Blyth, Mark (University of East Anglia)

Borja, Francisco (King Abdullah University of Science and Technology)

Bush, John (Massachusetts Institute of Technology)

Camassa, Roberto (University of North Carolina)

Choi, Wooyoung (New Jersey Institute of Technology)

Chumakova, Lyubov (Massachusetts Institute of Technology)

Cooker, Mark (University of East Anglia)

Deconinck, Bernard (University of Washington)

Duncan, James (University of Maryland)

Guyenne, Philippe (University of Delaware)

Henderson, Diane (Pennsylvania State University)

Henry, Legana (University of the West Indies)

Kasimov, Aslan (King Abdullah University of Science and Technology)

Kutz, Nathan (University of Washington)

Lannes, David (Ecole Normale Supérieure and CNRS)

McLaughlin, Richard (University of North Carolina)

Milewski, Paul (University of Bath)

Murashige, Sunao (Future University Hakodate)

Nachbin, Andre (Instituto Nacional de Matemática Pura e Aplicada)

Nicholls, David (University of Illinois at Chicago)

Parau, Emilian (University of East Anglia)

Rosales, Rodolfo (Massachusetts Institute of Technology)

Segur, Harvey (University of Colorado)

Siegel, Michael (New Jersey Institute of Technology)

Tabak, Esteban (Courant Institute)

Trichtchenko, Olga (University of Washington)

Wang, Zhan (University of Wisconsin)

Wilkening, Jon (UC, Berkeley)

Zhang, Jun (Courant Institute)

Computational Complexity

July 7-12, 2013

Organizers:

Paul Beame (University of Washington)
Russell Impagliazzo (UC, San Diego)
Valentine Kabanets (Simon Fraser University)

Toni Pitassi (University of Toronto)
Avi Wigderson (Institute for Advanced Study)



Computational complexity is a field of research whose main objective is to understand the power and limitation of efficient computation. The area was born in the 1960's, when it was realized that some problems solvable in principle on a computer may not be solvable in practice, as they may not have any efficient algorithmic solution. Complexity theory has witnessed quite remarkable progress since its inception, with new methods developed, some questions resolved, and many more important open questions formulated. Despite this progress, many basic questions about efficient computation remain unresolved. One of the main open questions is the famous "P versus NP" problem, considered one of the most important challenges for mathematical research in the 21st century. The workshop brought together the top experts on computational complexity from around the world to examine some recent methods and tools developed in complexity theory and propose new directions of research.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5010>

Participants:

Aaronson, Scott (Massachusetts Institute of Technology)
Ben-Sasson, Eli (Technion)
Braverman, Mark (Princeton University)
Chen, Ruiwen (Simon Fraser University)
Cook, Stephen (University of Toronto)
Drucker, Andrew (Institute for Advanced Study)
Dvir, Zeev (Princeton University)
Goos, Mika (University of Toronto)
Gopalan, Parikshit (Microsoft Research Silicon Valley)
Impagliazzo, Russell (UC, San Diego)
Kabanets, Valentine (Simon Fraser University)
Kane, Daniel (Stanford University)
Khot, Subhash (New York University)
Kolokolova, Antonina (Memorial University of Newfoundland)
Kopparty, Swastik (Rutgers)
Lovett, Shachar (Institute for Advanced Study)
Moshkovitz, Dana (Massachusetts Institute of Technology)
O'Donnell, Ryan (Carnegie Mellon University)
Oshman, Rotem (University of Toronto)
Pitassi, Toni (University of Toronto)

Raghavendra, Prasad (UC, Berkeley)
Rao, Anup (University of Washington)
Regev, Oded (New York University)
Rossman, Ben (National Institute of Informatics)
Saks, Michael (Rutgers University)
Santhanam, Rahul (University of Edinburgh)
Saraf, Shubhangi (Rutgers University)
Saurabh, Nitin (Institute of Mathematical Sciences)
Servedio, Rocco (Columbia University)
Shaltiel, Ronen (University of Haifa)
Sherstov, Alexander (UC, Los Angeles)
Steurer, David (Cornell University)
Sudan, Madhu (Microsoft Research)
Trevisan, Luca (Stanford University)
Vadhan, Salil (Harvard University)
Vassilevska-Williams, Virginia (Stanford University and UC, Berkeley)
Watanabe, Osamu (Tokyo Institute of Technology)
Wigderson, Avi (Institute for Advanced Study)
Williams, Ryan (Stanford University)
Yehudayoff, Amir (Technion - Israel Institute of Technology)
Zuckerman, David (University of Texas, Austin)

Mathematics and Mechanics in the Search for New Materials

July 14-19, 2013

Organizers:

John Ball (University of Oxford)

Kaushik Bhattacharya (California Institute of Technology)

Antonio DeSimone (Scuola Internazionale Superiore di Studi Avanzati)



Materials science is undergoing rapid development. A number of new techniques for synthesis have recently been introduced, and it is possible today to synthesize compounds today that were impossible a decade ago. New techniques of characterization, including scanning probe microscopy, are now available and they have provided a new view on material microstructure. Finally, the availability of computational power has made it possible to study a number of previously inaccessible problems. Yet, most materials are still discovered through inspired accident and improved through expert empiricism. The essential reason for this is the complexity and the range of interactions between the electronic, atomistic, microstructural and macroscopic scales that determine the properties of materials. This workshop brought together a diverse group of mathematical and physical scientists to apply mathematics to understand this complexity. A specific focus was on active materials and materials of interest to energy storage and conversion.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5004>

Participants:

Abeyaratne, Rohan (Massachusetts Institute of Technology)

Ball, John (University of Oxford)

Banerjee, Amartya (University of Minnesota)

Bhattacharya, Kaushik (California Institute of Technology)

Chen, Xian (University of Minnesota)

Clifton, Rod (Brown University)

Dabade, Vivekanand (University of Minnesota)

Daly, Samantha (University of Michigan)

Dayal, Kaushik (Carnegie Mellon University)

DeSimone, Antonio (Scuola Internazionale Superiore di Studi Avanzati)

Dolzmann, Georg (University of Regensburg)

Eliot, Ryan (University of Minnesota)

Fonseca, Irene (Center for Nonlinear Analysis)

Freund, Ben (University of Illinois at Urbana-Champaign)

Friesecke, Gero (Technische Universität München)

Gavini, Vikram (University of Michigan)

Healey, Tim (Cornell University)

31 **James, Richard D.** (University of Minnesota)

Kim, Kyung-Suk (Brown University)

Kim, Saeja O. (University of Massachusetts Dartmouth)

Kinderlehrer, David (Carnegie Mellon University)

Kohn, Robert (New York University)

Liu, Liping (Rutgers University)

Luskin, Mitchell (University of Minnesota)

Milton, Graeme (University of Utah)

Mora, Maria Giovanna (Università degli Studi di Pavia)

Otto, Felix (Max Planck Institute for Mathematics in the Sciences)

Reina, Celia (University of Pennsylvania)

Rizzoni, Raffaella (University of Ferrara)

Safranek, Lee (Simon Fraser University)

Salje, Ekhard (University of Cambridge)

Schlömerkemper, Anja (University of Würzburg)

Schryvers, Dominique (University of Antwerp)

Sittner, Petr (Institute of Physics of the AVCR)

Song, Yintao (University of Minnesota)

Takeuchi, Ichiro (University of Maryland)

Twarock, Reidun (York University)

Wuttig, Manfred (University of Maryland)

Permutation Groups

July 21-26, 2013

Organizers:

Robert Guralnick (University of Southern California) **Katrin Tent** (Universität Münster)
Cheryl Praeger (University of Western Australia) **Donna Testerman** (École Polytechnique Fédérale de Lausanne)



This workshop brought together leading researchers in these related areas as well as those whose research centres on permutation groups. This was a follow up to meetings on the subject in Oberwolfach and Banff. In both instances bringing together the leading researchers in different areas related to permutation groups and their applications as well as exposing top graduate students and younger researchers has led to significant new results.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5033>

Participants:

Aschbacher, Michael (California Institute of Technology)
Baumeister, Barbara (Universitaet Bielefeld)
De Medts, Tom (Ghent University)
Devillers, Alice (University of Western Australia)
Dolfi, Silvio (Universita' di Firenze)
Fawcett, Joanna (Cambridge University)
Fulman, Jason (University of Southern California)
Garcia-Armas, Mario (University of British Columbia)
Gulko, Dennis (Ben-Gurion University of the Negev)
Guralnick, Robert (University of Southern California)
Hiss, Gerhard (RWTH Aachen University)
Kantor, William (University of Oregon)
Kassabov, Martin (Cornell University)
Liebeck, Martin (Imperial College London)
Lübeck, Frank (RWTH Aachen)
MacPherson, Dugald (University of Leeds)
Magaard, Kay (University Birmingham)
Malle, Gunter (Technische Universität Kaiserslautern)
Marion, Claude (University of Fribourg)
Morgan, Luke (University of Western Australia)

Morris, Joy (University of Lethbridge)
Praeger, Cheryl (University of Western Australia)
Pyber, Laci (Renyi Institute of Mathematics Budapest)
Reichstein, Zinovy (University of British Columbia)
Schaeffer Fry, Amanda (Michigan State University)
Segev, Yoav (Ben Gurion University)
Seitz, Gary (University of Oregon)
Shareshian, John (Washington University)
Silberman, Lior (University of British Columbia)
Smith, Simon (New York City College of Technology and City University of New York)
Smith, Stephen (University of Illinois-Chicago)
Spiga, Pablo (University of Milano-Bicocca)
Stewart, David (Oxford University)
Testerman, Donna (École Polytechnique Fédérale de Lausanne)
Tong-Viet, Hung (University of KwaZulu-Natal)
Verret, Gabriel (University of Primorska)
Willis, George (Newcastle Australia)
Wilson, James (Colorado State University)
Wiscons, Joshua (Universität Münster)

Spectral Theory of Laplace and Schroedinger Operators

July 28 - August 2, 2013

Organizers:

Mark Ashbaugh (University of Missouri-Columbia) **Iosif Polterovich** (Université de Montréal)
Rafael Benguria (Pontificia Universidad Catolica de Chile) **Timo Weidl** (Universität Stuttgart)
Richard Laugesen (University of Illinois)



The workshop on Spectral Theory of Laplace and Schrödinger Operators brought together scientists working on isoperimetric inequalities and shape optimization, universal and semi-classical inequalities, and the nodal geometry of eigenfunctions, in an effort to better understand the geometrical constraints that nature places upon physics.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5059>

Participants:

Ashbaugh, Mark (University of Missouri-Columbia) **Hermi, Lotfi** (University of Arizona)
Band, Rami (University of Bristol) **Hundertmark, Dirk** (Karlsruhe Institute of Technology)
Benguria, Rafael (Pontificia Universidad Catolica de Chile) **Jakobson, Dmitry** (McGill University)
Berkolaiko, Gregory (Texas A&M University) **Langford, Jeffrey** (Bucknell University)
Burchard, Almut (University of Toronto) **Laptev, Ari** (Imperial College London)
Canzani, Yaiza (McGill University) **Laugesen, Richard** (University of Illinois)
Chiacchio, Francesco (Università degli Studi di Napoli) **Levitin, Michael** (University of Reading)
Clutterbuck, Julie (Australian National University) **Lieb, Elliott H.** (Princeton University)
Denzler, Jochen (University of Tennessee) **Loss, Michael** (Georgia Institute of Technology)
Dolbeault, Jean (Université Paris Dauphine) **Lu, Zhiqin** (UC, Irvine)
Frank, Rupert (Princeton University) **Nigam, Nilima** (Simon Fraser University)
Freitas, Pedro (University of Lisbon) **Parnovski, Leonid** (University College London)
Friedlander, Leonid (University of Arizona) **Poliquin, Guillaume** (Université de Montréal)
Geisinger, Leander (Princeton University) **Polterovich, Iosif** (Université de Montréal)
Girouard, Alexandre (l'Université de Savoie) **Roy-Fortin, Guillaume** (Université de Montréal)
Harrell, Evans (Georgia Institute of Technology) **Savo, Alessandro** (Sapienza Università di Roma)
Hasnaoui, Abdelhalim (University of Tunis El Manar) **Siudeja, Bartłomiej** (University of Oregon)
Helffer, Bernard (Université Paris Sud) **Steinerberger, Stefan** (University of Bonn)
Henrot, Antoine (Institut Elie Cartan) **Weidl, Timo** (Universität Stuttgart)
Herbrich, Peter (Dartmouth College)

Metric Geometry, Geometric Topology and Groups

August 4-9, 2013

Organizers:

Steve Ferry (Rutgers University)
Alexander Nabutovsky (University of Toronto)

Shmuel Weinberger (University of Chicago)



This workshop brought people who study geometry synthetically, and for different reasons, together to discuss common problems, and use varying techniques that arise more or less naturally in different settings. Most participants either study problems related to area and volume on manifolds (and metric measure spaces), the geometry of groups, or the geometric topology of manifolds and their limits. There have been a number of areas of interactions of these fields through the use of algebraic topology in systolic geometry, random walks and Banach space geometry in all three areas, and in the application of tools from geometric group theory in topological rigidity theory.

Given the interdisciplinary nature of the meeting, education was a central component, as well as contributing to the training of graduate students and postdocs, and giving younger mathematicians a chance to gain a wider exposure for their work.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5040>

Participants:

Avramidi, Grigori (University of Chicago)
Babenko, Ivan (Université de Montpellier II)
Balacheff, Florent (Université de Lille 1)
Belegradek, Igor (Georgia Tech)
Bestvina, Mladen (University of Utah)
Chambers, Greg (University of Toronto)
Dotterrer, Dominic (University of Toronto)
Dranishnikov, Alexander (University of Florida)
Dymarz, Tullia (University of Wisconsin, Madison)
Ferry, Steve (Rutgers University)
Ghomi, Mohammad (Georgia Institute of Technology)
Gluck, Herman (University of Pennsylvania)
Hamenstaedt, Ursula (Universität Bonn)
Jakobson, Dmitry (McGill University)
Kahle, Matthew (Ohio State University)
LeDonne, Enrico (University of Jyväskylä)
Liokumovich, Yevgeny (University of Toronto)
Manin, Fedor (University of Chicago)

Mineyev, Igor (University of Illinois at Urbana-Champaign)
Mischaikow, Konstantin (Rutgers University)
Nabutovsky, Alexander (University of Toronto)
Naor, Assaf (New York University)
Nowak, Piotr (University of Warsaw)
Okun, Boris (University of Wisconsin-Milwaukee)
Parlier, Hugo (University of Fribourg)
Petrinin, Anton (Pennsylvania State University)
Roe, John (Pennsylvania State University)
Rotman, Regina (University of Toronto)
Sabourau, Stephane (University Paris-Est Créteil)
Schmidt, Ben (Michigan State University)
Shelukhin, Egor (CRM Montreal)
Weinberger, Shmuel (University of Chicago)
Wilking, Burkhard (University of Münster)
Yampolsky, Michael (University of Toronto)
Young, Robert (University of Toronto)

Statistical Data Integration Challenges in Computational Biology: Regulatory Networks and Personalized Medicine

August 11-16, 2013

Organizers:

Jennifer Bryan (University of British Columbia)
Aurelie Labbe (McGill University)
Stephen Montgomery (Stanford University)

Adam Olshen (UC, San Francisco)
Ronglai Shen (Memorial Sloan-Kettering Cancer Center)
Paul Spellman (Oregon Health & Science University)



The primary objectives of this workshop were: (1) to identify statistical challenges that arise in integrated analyses of high-throughput biomedical and genomic data; (2) to present and critique solutions to these problems, with the goal of determining the strategies that will be most effective for yielding significant, reproducible biological and clinical discoveries; (3) to bring together diverse individuals working at the forefront of high-throughput data generation and analysis.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5083>

Participants:

Baggerly, Keith (MD Anderson Cancer Center)
Battle, Alexis (Stanford University)
Begg, Colin (Memorial Sloan Kettering Cancer Center)
Bengtsson, Henrik (UC, San Francisco)
Boyd, Scott (Stanford University)
Bryan, Jennifer (University of British Columbia)
Chen, Mengjie (Yale University)
Creighton, Chad (Baylor College of Medicine)
Dudoit, Sandrine (UC, Berkeley)
Gilad, Yoav (University of Chicago)
Gravel, Simon (McGill University)
Hansen, Kasper (John Hopkins University)
Haussler, David (UC, Santa Cruz)
Herbrich, Shelley (MD Anderson Cancer Center)
Huber, Wolfgang (European Molecular Biology Laboratory)
Jacob, Laurent (Centre National de Recherche Scientifique)
Kains, Benjamin Haibe (Institut de Recherches Cliniques de Montréal)
Keles, Sunduz (University of Wisconsin, Madison)
Kellis, Manolis (Massachusetts Institute of Technology)
Kendzierski, Christina (University of Wisconsin)
Kundaje, Anshul (Massachusetts Institute of Technology)

Leek, Jeff (Johns Hopkins University)
Liu, X. Shirley (Dana-Farber Cancer Institute and Harvard University)
Molinario, Annette (UC, San Francisco)
Montgomery, Stephen (Stanford University)
Neuviel, Pierre (CNRS and University of Evry)
Olshen, Adam (UC, San Francisco)
Ostrovnya, Irina (Memorial Sloan-Kettering Cancer Center)
Peng, Roger (Johns Hopkins University)
Qin, Steve (Emory University)
Quigley, David (UC, San Francisco)
Risso, Davide (UC, Berkeley)
Ruczinski, Ingo (Johns Hopkins University)
Segal, Mark (UC, San Francisco)
Seshan, Venkatraman (Memorial Sloan-Kettering Cancer Center)
Shen, Ronglai (Memorial Sloan-Kettering Cancer Center)
Simon, Noah (Stanford University)
Stephens, David (McGill University)
Taub, Margaret (Johns Hopkins University)
Taylor, Barry (UC, San Francisco)
Wang, Pei (Fred Hutchinson Cancer Research Center)
Zhao, Hongyu (Yale University)

WIT: Women in Topology

August 18-23, 2013

Organizers:

Maria Basterra (University of New Hampshire)
Kristine Bauer (University of Calgary)

Kathryn Hess (Ecole Polytechnique Federale de Lausanne)
Brenda Johnson (Union College)



The purpose of the workshop was to support and expand research efforts by female mathematicians in the field of homotopy theory. It was inspired by the success of the networking group WIN of women in number theory and the format of their workshops held at BIRS in 2008 and 2011.

The workshop consisted of a number of joint research projects to be started during the meeting that could lead to future collaborations among the participants. It was the intention to publish proceedings of the workshop, which would consist of articles written by each of the research groups on the results they obtained.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5145>

Participants:

Aponte Roman, Camil (University of Washington)
Basterra, Maria (University of New Hampshire)
Bauer, Kristine (University of Calgary)
Bayeh, Marzieh (University of Regina)
Beaudry, Agnes (Northwestern University)
Bergner, Julie (UC, Riverside)
Bobkova, Irina (Northwestern University)
Bohmann, Anna Marie (Northwestern University)
Coufal, Vesta (Gonzaga University)
Eldred, Rosona (Universitaet Hamburg)
Hess, Kathryn (École polytechnique fédérale de Lausanne)
Joachimi, Ruth (Universitat Wuppertal)
Johnson, Brenda (Union College)
Karpova, Varvara (École polytechnique fédérale de Lausanne)
Kedziorek, Magdalena (University of Sheffield)
Lesh, Kathryn (Union College)
Lindenstrauss, Ayelet (Indiana University)
Livernet, Muriel (Universite Paris 13)
Mazur, Kristen (University of Virginia)
Merling, Mona (University of Chicago)

Osorno, Angelica (University of Chicago)
Ozornova, Viktoriya (Universitat Bonn)
Pelatt, Kristine (St. Catherine University)
Poirier, Kate (UC, Berkeley)
Ponto, Kate (University of Kentucky)
Pronk, Dorette (Dalhousie University)
Richter, Birgit (University of Hamburg)
Riehl, Emily (Harvard University)
Robertson, Marcy (University of Western Ontario)
Rovi, Carmen (University of Edinburgh)
Scull, Laura (Fort Lewis College)
Shiple, Brooke (University of Illinois, Chicago)
Stojanoska, Vesna (MIT/MSRI)
Thatcher, Courtney (Bard College at Simon's Rock)
Whitehouse, Sarah (University of Sheffield)
Wickelgren, Kirsten (Georgia Institute of Technology)
Yarnall, Carolyn (University of Virginia)
Yeakel, Sarah (University of Illinois at Urbana-Champaign)
Zakharevich, Inna (University of Chicago)
Ziegenhagen, Stephanie (Universitat Hamburg)

Integrable Systems and Moduli Spaces

August 25-30, 2013

Organizers:

Dmitry Korotkin (Concordia University)

Peter Zograf (Steklov Mathematical Institute of the Russian Academy of Sciences)



The main objectives of this conference were: 1) to foster interactions among the researchers working in the fields of integrable systems, algebraic geometry of moduli spaces and related areas of mathematics and mathematical physics (such as random matrices, dynamical systems, etc.); 2) based on these interactions, to design new mathematical tools and to achieve new progress in the fields of integrable systems and moduli spaces (in particular to better understand the algebro-geometric aspects of integrability and to apply this knowledge to intersection theory on various moduli spaces associated with complex algebraic curves); and 3) to use this conference as an opportunity to involve younger researchers in discussions with senior mathematicians, which would be beneficial for their scientific development and could lead to new ideas.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5064>

Participants:

Anco, Stephen (Brock University)

Basok, Mikhail (St.Petersburg State University)

Borot, Gaëtan (Max Planck Institut fuer Mathematik)

Bothner, Thomas (Indiana University-Purdue University Indianapolis)

Bouchard, Vincent (University of Alberta)

Bridgeland, Tom (University of Sheffield)

Chen, Dawei (Boston College)

Chowdhury, Syed (Concordia University)

de Jong, Robin (University of Leiden)

Farkas, Gavril (Humboldt Universität zu Berlin)

Fordyce, Jordan (University of Alberta)

Grushevsky, Samuel (Stony Brook University)

Harnad, John (Centre de recherches mathématiques, Université de Montréal, and Concordia University)

Hurtubise, Jacques (McGill University)

Kazarian, Maxim (Steklov Mathematical Institute)

Kimura, Takashi (Boston University)

Kokotov, Alexey (Concordia University)

Korotkin, Dmitry (Concordia University)

Lando, Sergej (Higher School of Economics Moscow)

McIntyre, Andrew (Bennington College)

Moeller, Martin (Goethe University Frankfurt)

Mulase, Motohico (UC, Davis)

Norbury, Paul (University of Melbourne)

Norton, Chaya (Stony Brook University)

Park, Jinsung (Kule Institute for Advanced Study)

Previato, Emma (Boston University)

Saenz, Axel (UC, Davis)

Schmitt, Alexander (Freie Universität Berlin)

Shadrin, Sergey (University of Amsterdam)

Shramchenko, Vasilisa (Université de Sherbrooke)

Soloviev, Fedor (University of Toronto)

van der Geer, Gerard (University of Amsterdam)

Voronov, Alexander (University of Minnesota)

Zakharov, Dmitry (Stony Brook University)

Zograf, Peter (Steklov Mathematical Institute of the Russian Academy of Sciences)

Zvonkine, Dimitri (Centre de recherches mathématiques)

Modeling High-Frequency Trading Activity

September 1-6, 2013

Organizers:

Ramo Gencay (Simon Fraser University)

Richard Olsen (Olsen Ltd)



This workshop brought together financial market participants with experts from economics, finance, mathematics and statistics to improve the understanding of how ultra-high-frequency trading is changing financial markets. Trading has become so fast within the past decade, that there is no real-time human judgment behind the majority of trading decisions in today's markets. Instead, cleverly programmed computers are now involved in approximately 75% of trades in U.S. stock markets. This workshop aimed to improve the understanding of this new class of traders and their impact on the overall market.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5008>

Participants:

Agliardi, Rossella (University of Bologna)
Ait-Sahalia, Yacine (Princeton University)
Almgren, Robert (Quantitative Brokers)
Andersen, Torben (Northwestern University)
Ao, Han (University of Essex)
Bae, Kyoung-hun (University of Maryland)
Bell, Peter (University of British Columbia)
Bouchaud, Jean-Philippe (Capital Fund Management)
Brogaard, Jonathan (University of Washington)
Chaboud, Alain (Federal Reserve Board)
Djurđević, Deana (TMX Group Limited)
Embrechts, Paul (ETH Zurich)
Filimonov, Vladimir (ETH Zurich)
Foucault, Thierry (HEC Paris)
Garriott, Corey (Bank of Canada)
Gencay, Ramo (Simon Fraser University)
Gradojević, Nikola (Lille Catholic University-IESEG and Lakehead University)
Gray, Kyle (Bank of Canada)
Harris, Larry (University of Southern California)
Hendershott, Terrence (UC, Berkeley)
Ivliev, Sergey (PROGNOZ)
Jones, Robert (Simon Fraser University)
Kasa, Ken (Simon Fraser University)

Kirchner, Matthias (ETH Zurich)
Kirilenko, Andrei (Massachusetts Institute of Technology)
Kyle, Albert S. (University of Maryland)
Lamacie, Guilherme (BM&FBovespa S.A.)
Li, Wei (University of Maryland)
Lillo, Fabrizio (Scuola Normale Superiore di Pisa)
Mahmoodzadeh, Soheil (Simon Fraser University)
Olsen, Richard (Olsen Ltd)
Parlour, Christine (UC, Berkeley)
Ping, Li (University Electronic Science and Technology of China)
Schmidt, Alec (Kensho Finance)
Stanley, Eugene (Boston University)
Sutter, Barbara Caroline (Swiss National Bank)
Tsang, Edward (University of Essex)
Tseng, Michael (Simon Fraser University)
Vatter, Thibault (University of Lausanne)
Xu, Jiangmin (Princeton University)
Xue, Yi (University of International Business and Economics)
Yu, Xiao (Christy) (Simon Fraser University)
Zhang, Kerry (Simon Fraser University)
Zumbach, Gilles (SwissQuant)

Random Measures and Measure-Valued Processes

September 8-13, 2013

Organizers:

Jean Bertoin (Universität Zürich)
Shui Feng (McMaster University)
Paul Joyce (University of Idaho)

Ramsés H. Mena Chávez (Universidad Nacional Autónoma de México)



It was timely for an inter-discipline dialog on strategies for future development in random measures and measure-valued processes. This workshop brought together researchers in several closely related areas including random partitions, stochastic analysis, measure-valued processes, stochastic models in population genetics, and Bayesian non-parametric statistics. The overall objectives were: 1) to provide a platform for the exchange of information and knowledge between different research groups and areas; 2) to tackle open problems; and 3) to discuss for future directions in the research of random measure and measure-valued processes.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5007>

Participants:

Bertoin, Jean (Universität Zürich)
Blath, Jochen (Technical University Berlin)
Dawson, Donald (Carleton University)
Delmas, Jean-Francois (Université Paris-Est)
Etheridge, Alison (University of Oxford)
Fang, Shizan (Universite de Bourgogne)
Favaro, Stefano (University of Torino and Collegio Carlo Alberto)
Feng, Shui (McMaster University)
Foucart, Clément (Technical University of Berlin)
Griffiths, Robert C. (University of Oxford)
Handa, Kenji (Saga University)
Hening, Alexandru (UC, Berkeley)
James, Lancelot F. (Hong Kong University of Science and Technology)
Joyce, Paul (University of Idaho)
Lijoi, Anthonio (University of Pavia)
Méléard, Sylvie (École Polytechnique)
Mena Chávez, Ramsés H. (Universidad Nacional Autónoma de México)

Moehle, Martin (University of Tuebingen)
Orbanz, Peter (Columbia University)
Pardo Millan, Juan Carlos (Centro de Investigación en Matemáticas)
Pfaffelhuber, Peter (University of Freiburg)
Popovic, Lea (Concordia University)
Pruenster, Igor (University of Torino and Collegio Carlo Alberto)
Ruggiero, Matteo (University of Torino)
Spanò, Dario (University of Warwick)
Sturm, Anja (University of Göttingen)
Sun, Wei (Concordia University)
Teh, Yee Whye (University of Oxford)
Wakolbinger, Anton (Goethe-University)
Winter, Anita (Universität Duisburg-Essen)
Xiong, Jie (University of Tennessee)
Yu, Feng (University of Bristol)
Zhou, Xiaowen (Concordia University)
Zhou, Youzhou (McMaster University)

Geometry and Inverse Problems

September 15-20, 2013

Organizers:

Gabriel Paternain (University of Cambridge)
Mikko Salo (University of Jyväskylä)

Gunther Uhlmann (University of Washington)



An outstanding inverse problem in geophysics consists in determining the inner structure of the Earth from measurements of travel times of seismic waves. From a mathematical point of view, the inner structure of the Earth is modelled by a Riemannian metric, and the travel times by the lengths of unit speed geodesics between boundary points. This gives rise to a typical geometric inverse problem: is it possible to determine a Riemannian metric from its boundary distance function? This workshop addressed this and several other related open problems, including injectivity questions for ray transforms and the celebrated Calderón problem and brought together an international group of renowned researchers in geometry and analysis to investigate these central questions.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5036>

Participants:

Ainsworth, Gareth (University of Cambridge)
Alexakis, Spyros (University of Toronto)
Besson, Gérard (Université Grenoble, CNRS)
Croke, Chris (University of Pennsylvania)
Datchev, Kiril (Massachusetts Institute of Technology)
de Hoop, Maarten (Purdue University)
Dos Santos Ferreira, David (Université de Lorraine)
Dunajski, Maciej (Cambridge University)
Eastwood, Michael (Australian National University)
Felea, Raluca (Rochester Institute of Technology)
Graham, Robin (University of Washington)
Herreros, Pilar (Pontificia Universidad Católica)
Holman, Sean (Purdue University)
Ilmavirta, Joonas (University of Jyväskylä)
Krupchyk, Katya (University of Helsinki)
Lassas, Matti (University of Helsinki)

Mason, Lionel (Oxford University)
Mazzeo, Rafe (Stanford University)
McDowall, Stephen (Western Washington University)
Monard, Francois (University of Washington)
Nachman, Adrian (University of Toronto)
Oksanen, Lauri (University of Helsinki)
Paternain, Gabriel (University of Cambridge)
Saksala, Teemu (University of Helsinki)
Salo, Mikko (University of Jyväskylä)
Stefanov, Plamen (Purdue University)
Strohmaier, Alex (University of Loughborough)
Tamasan, Alexandru (University of Central Florida)
Uhlmann, Gunther (University of Washington)
Vasy, András (Stanford University)
Yang, Yang (University of Washington)
Zhou, Hanming (University of Washington)

Uncovering Transport Barriers in Geophysical Flows

September 22-27, 2013

Organizers:

George Haller (ETH Zurich)

Thomas Peacock (Massachusetts Institute of Technology)

Jean-Luc Thiffeault (University of Wisconsin)



The purpose of this workshop was to bring together pure and applied mathematicians, engineers, geoscientists and representatives from industry and government to pursue the common goals of: 1) developing new methods for uncovering transport barriers in geophysical flows, and 2) determining how to make these methods amenable to real-world implementation.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5089>

Participants:

Allshouse, Michael (Massachusetts Institute of Technology)

Balasuriya, Sanjeeva (University of Adelaide)

Beron-Vera, Francisco (RSMAS, University of Miami)

Blazevski, Daniel (ETH Zurich)

Bolt, Erik (Clarkson University)

Budisic, Marko (University of Wisconsin)

del-Castillo-Negrete, Diego (Oak Ridge National Laboratory)

Froyland, Gary (University of New South Wales)

Green, Melissa (Syracuse University)

Haller, George (ETH Zurich)

Leclair, Matthieu (Massachusetts Institute of Technology)

Lermusiaux, Pierre (Massachusetts Institute of Technology)

Mezic, Igor (UC, Santa Barbara)

Olascoaga, Josefina (University of Miami)

Ouellette, Nicholas (Yale University)

Peacock, Thomas (Massachusetts Institute of Technology)

Pratt, Larry (Woods Hole Oceanographic Institution)

Ross, Shane (Virginia Tech)

Rowley, Clancy (Princeton University)

Rypina, Irina (Woods Hole Oceanographic Institution)

Shadden, Shawn (Illinois Institute of Technology)

Surana, Amit (United Technologies Research Center)

Thiffeault, Jean-Luc (University of Wisconsin)

Entanglement in Curved Spacetime

September 22-27, 2013

Organizers:

Achim Kempf (University of Waterloo)
Robert Mann (University of Waterloo)

Gerard Milburn (The University of Queensland)



The greatest challenge in contemporary physics is the unification of general relativity with quantum theory. Mathematically, the key challenge is to bridge between the very different mathematical methods of general relativity on one hand and those of quantum theory on the other hand. In this context, this workshop focused on the exploration of new avenues of research for the mathematical description of the effects that spacetime relativity has on the universal phenomenon of quantum entanglement. To this end, the workshop brought together the most prominent researchers in the subject of relativistic quantum information, as well as some of their best postdoctoral fellows and graduate students. The workshop was timely, because of recently-emerged prospects for experimental tests of phenomena of relativistic quantum information, for example, using quantum communication with satellite-based instruments.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5153>

Participants:

Ahmadzadegan, Aida (University of Waterloo)
Brown, Eric (University of Waterloo)
Donnelly, William (University of Waterloo)
Dragan, Andzej (University of Wrazlaw)
Hotta, Masahiro (Tohoku University)
Hu, Bei-Lok (University of Maryland)
Jonsson, Robert (University of Waterloo)
Kempf, Achim (University of Waterloo)
León, Juan (Consejo Superior de Investigaciones Científicas)
Louko, Jorma (University of Nottingham)
Mann, Robert (University of Waterloo)

Martin-Benito, Mercedes (Perimeter Institute)
Martin-Martinez, Eduardo (University of Waterloo)
Menicucci, Nicolas (The University of Sydney)
Myers, Casey (The University of Queensland)
Ralph, Timothy (University of Queensland)
Reznik, Benni (Tel Aviv University)
Sanders, Barry (University of Calgary)
Schuetzhold, Ralf (Universitaet Duisburg-Essen)
Unruh, Bill (University of British Columbia)
Wang, Tian (University of Calgary)

Geometric and Topological Graph Theory

September 29 - October 4, 2013

Organizers:

Bojan Mohar (Simon Fraser University)
Janos Pach (Ecole Polytechnique Federale de Lausanne and Renyi Institute)

Paul Seymour (Princeton University)
Robin Thomas (Georgia Institute of Technology)
Carsten Thomassen (Technical University of Denmark)



This workshop was a continuation of a highly successful BIRS workshop that was organized in 2006 (see http://www.birs.ca/birspages.php?task=displayevent&event_id=06w5067). That workshop focused on bringing together researchers working in topological graph theory with those working in geometric graph theory and crossing numbers. This workshop also included some of the main protagonists in newly emerging area of Computational topology (H. Edelsbrunner, J. Erickson, E. Colin de Verdiere, S. Cabello). Invited, were a number of graduate students and postdocs who specialised in one of the areas, and would be able learn a great deal about the methods, results and open problems in the areas of topological graph theory, geometric graph theory and computational topology.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5091>

Participants:

Archdeacon, Dan (University of Vermont)
Berger, Eli (Haifa University)
Bokal, Drago (University of Maribor)
Cabello, Sergio (University of Ljubljana)
Churchley, Ross (Simon Fraser University)
Dujmović, Vida (University of Ottawa)
Dvorak, Zdenek (Charles University, Prague)
Edwards, Katherine (Princeton University)
Ellingham, Mark (Vanderbilt University)
Fox, Jacob (Massachusetts Institute of Technology)
Fulek, Radoslav (Charles University)
Gauthier, Gregory (Princeton University)
Goddyn, Luis (Simon Fraser University)
Haxell, Penny (University of Waterloo)
Kim, Ringi (Princeton University)
Klimosova, Tereza (University of Warwick)
Kostochka, Alexandr (University of Illinois at Urbana-Champaign)
Li, Zhentao (Ecole Normale Supérieure de Lyon)
Liu, Chun-Hung (Georgia Tech)
Mohar, Bojan (Simon Fraser University)

Noel, Jonathan (Oxford University)
Norin, Sergey (McGill University)
Pach, Janos (Ecole Polytechnique Federale de Lausanne and Renyi Institute)
Plumettaz, Matthieu (Columbia University)
Postle, Luke (Emory University)
Reed, Bruce (McGill University)
Rus, Jernej (IMFM & CosyLab)
Salazar, Gelasio (Universidad Autonoma de San Luis Potosi)
Scott, Alex (University of Oxford)
Seymour, Paul (Princeton University)
Širáň, Jozef (Open University)
Tóth, Géza (Renyi Institute)
Whalen, Peter (Georgia Tech)
Wood, David (Monash University)
Wu, Hehui (Simon Fraser University)
Yancey, Matthew (Institute for Defense Analysis)
Yepremyan, Liana (McGill University)
Yuditsky, Lena (McGill University)
Zhao, Yufei (Massachusetts Institute of Technology)

The Role of Oceans in Climate Uncertainty

October 6-11, 2013

Organizers:

Montserrat Fuentes (North Carolina State University)
Peter Guttorp (University of Washington)

Michael Stein (University of Chicago)



The workshop was intended as a forum for interaction between statisticians, stochasticists, climate modelers, ocean observers and data assimilators with a goal to develop observation strategies and design computer experiments to better understand the model and data uncertainties that relate directly to oceans and ocean-related feedback mechanisms. The timing is good in that the studies that form the basis for the fifth assessment report of the IPCC are expected to be finished before the workshop. During the final day participants drafted a comprehensive statement about what is required in order to be able to answer scientifically and politically crucial questions relating to the role of oceans in climate.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5104>

Participants:

Bailey, Barbara (San Diego State University)
Bingham, Frederick (University of North Carolina at Wilmington)
Brierley, Chris (University College London)
Challenor, Peter (University of Exeter)
Choi, InKyung (Purdue University)
Dowd, Mike (Dalhousie University)
Gebbie, Jake (Woods Hole Oceanographic Institution)
Guillas, Serge (University College London)
Guttorp, Peter (University of Washington)
Hammerling, Dorit (National Center for Atmospheric Research)
He, Xian (Purdue University)
Heimbach, Patrick (Massachusetts Institute of Technology)

Lin, Lina (University of Washington)
Liu, Yang (University of British Columbia)
Nychka, Douglas (National Center for Atmospheric Research)
Prelaj, Sidorela (Polytechnic University of Tirana)
Sanso, Bruno (University of California Santa Cruz)
Schmidt, Alexandra Mello (Instituto de Matemática - UFRJ)
Smith, Leonard (London School of Economics and Political Science)
Stein, Michael (University of Chicago)
Tokmakian, Robin (Naval Postgraduate School)
Wallace, Jim (University of Washington)
Williamson, Danny (University of Exeter)
Zhang, Hao (Purdue University)
Zimmerman, Aaron (University of Washington)

Whittaker Functions: Number Theory, Geometry and Physics

October 13-18, 2013

Organizers:

Ben Brubaker (University of Minnesota)
Daniel Bump (Stanford University)
Gautam Chinta (City College of New York)

Solomon Friedberg (Boston College)
Paul Gunnells (University of Massachusetts Amherst)



Whittaker functions are higher-dimensional generalizations of classical Bessel functions that arise naturally as solutions to rather independent problems in number theory and in physics. This workshop intended to explore the deeper connections between these two subjects suggested by their common link to Whittaker functions. By studying various modes of generalizing the notion of Whittaker functions, we witness new algebraic structure which hints at some of these possible connections. The fields of study which are brought to bear in these investigations include some of the most remarkable mathematics of the past half-century, including crystal graphs, quantum groups, and the Yang-Baxter equation. The workshop brought together a mix of experts and junior faculty in these and related areas in an attempt to make further progress in this rapidly evolving field.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5154>

Participants:

Beazley, Elizabeth (Haverford College)
Brubaker, Ben (University of Minnesota)
Buciumas, Valentin (Stanford)
Bump, Daniel (Stanford University)
Chhaibi, Reda (Universität Zürich)
Chinta, Gautam (City College of New York)
Ciubotaru, Dan (University of Utah)
Diaconu, Adrian (University of Minnesota)
Friedberg, Solomon (Boston College)
Friedlander, Holley (Williams College)
Hamel, Angèle (Wilfrid Laurier University)
Herman, P. Edward (University of Chicago)
Hironaka, Yumiko (Waseda University)
Hoffstein, Jeffrey (Brown)
Kim, Julee (Massachusetts Institute of Technology)
Kiral, Eren Mehmet (Brown)
Kleinschmidt, Axel (Max Planck Institute for Gravitational Physics)
Lee, Kyu-Hwan (University of Connecticut)
Lee, Ting Fang (National Taiwan University)

Lenart, Cristian (SUNY, Albany)
Lim, Li-Mei (Brown University)
Ma, Xiaoguang (Tsinghua University)
Miller, Andrea (University Duisburg-Essen)
Mok, Chung Pang (McMaster University)
Nakasuji, Maki (Sophia University)
Orr, Daniel (Virginia Tech)
Patnaik, Manish (University of Alberta)
Patterson, Samuel (Universitaet Goettingen)
Puskás, Anna (Columbia University)
Reshetikhin, Nicolai (UC, Berkeley)
Reznikov, Andre (Bar Ilan University)
Salisbury, Benjamin (Central Michigan University)
Schilling, Anne (UC, Davis)
Takeda, Shuichiro (University of Missouri)
Taniguchi, Takashi (Kobe University)
Templier, Nicolas (Princeton University)
Whitehead, Ian (Columbia University)
Zhang, Lei (Boston College)

Managing Fire on Populated Forest Landscapes

October 20-25, 2013

Organizers:

John (Willard) Braun (University of Western Ontario)
Charmaine Dean (University of Western Ontario)
Peter Guttorp (University of Washington)

David Martell (University of Toronto)
Douglas Woolford (Wilfrid Laurier University)
Mike Wotton (Canadian Forest Service)



The impact of evolving weather patterns and global atmospheric processes on fire regimes bears investigation. This workshop proposed to address ecological and fire management issues from a mathematical and statistical perspective. The workshop provided a forum for ecologists, climate modellers, fire scientists and managers to collaborate with mathematical programmers, modellers and spatial statisticians. Anticipated outcomes of the workshop were an improved understanding of the underlying processes, improved ecological and fire management tools which will assist in the mitigation of wildfire risk in populated areas.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5125>

Participants:

Albert-Green, Alisha (University of Western Ontario)
Baltar, Matthew (UC, Los Angeles)
Braun, John (University of Western Ontario)
Brillinger, David (UC, Berkeley)
Cumming, Steve (Université Laval)
Dean, Charmaine (University of Western Ontario)
Duchesne, Thierry (Université Laval)
Finn, Dave (Alberta Government)
Grunstra, Mary (Ryerson University)
Hearne, John (Royal Melbourne Institute of Technology)
Hu, Joan (Simon Fraser University)
Isham, Valerie (University College London)
Krawchuk, Meg (Simon Fraser University)
Kruus, Rob (Saskatchewan MNR)
Kulperger, Reg (University of Western Ontario)
Large, Jonathan (Parks Canada Agency)
Larson, Kate (University of Waterloo)
Martell, David (University of Toronto)
McAlpine, Rob (Ontario Ministry of Natural Resources)

McLoughlin, Neal (Government of Alberta)
Minas, James (Royal Melbourne Institute of Technology)
Morin, Amy (University of Western Ontario)
Moritz, Max (UC, Berkeley)
Park, Jane (Parks Canada)
Podschwit, Harry (University of Washington)
Preisler, Haiganoush (USDA Forest Service)
Robinne, Francois (University of Alberta)
Schoenberg, Rick (UC, Los Angeles)
Taylor, Steve (Canadian Forest Service)
Taylor, Peter (University of Melbourne)
Thompson, Dan (Natural Resources Canada)
van der Kamp, Derek (University of British Columbia)
Woolford, Douglas (Wilfrid Laurier University)
Wotton, Mike (Canadian Forest Service)
Xiong, Yi (Simon Fraser University)
Zwiers, Francis (Pacific Climate Impacts Consortium)

Disordered Quantum Many-body Systems

October 27- November 1, 2013

Organizers:

Michael Aizenman (Princeton University)
Bruno Nachtergaele (UC, Davis)

Robert Sims (University of Arizona)
Gunter Stolz (University of Alabama at Birmingham)



The central objective of this workshop was to stimulate research on open problems related to disordered many-body quantum systems. Since experts in these two fields have had limited contact in the past, a goal was to discuss recent progress made in both many-body theory and the theory of disordered systems, combining techniques and approaches from the different areas, with an eye towards possible cross fertilization. The workshop brought researchers from different areas of mathematical physics together to discuss questions such as: 1) what is many-body localization? and 2) how can resonances in many body quantum systems be analyzed, and what is their effect on spectra and dynamics?

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5058>

Participants:

Abanin, Dimitry (Perimeter Institute for Theoretical Physics)
Aizenman, Michael (Princeton University)
Bishop, Michael (University of Arizona)
De Roeck, Wojciech (Universitat Heidelberg)
Dias Barreto, Stephen (Padre Conceicao College of Engineering)
Elgart, Alexander (Virginia Tech)
Fischbacher, Christoph (Munich University)
Froese, Richard (University of British Columbia)
Hislop, Peter (University of Kentucky)
Huse, David (Princeton University)
Huveneers, Francois (Université Paris Dauphine)
Imbrie, John (University of Virginia)
Joye, Alain (Institut Fourier, Université Grenoble 1)
Klein, Abel (UC, Irvine)
Klopp, Frederic (Université Pierre et Marie Curie)
Knowles, Antti (New York University)
Lewin, Mathieu (CNRS / University of Cergy-Pontoise)
Merkli, Marco (Memorial University of Newfoundland)
Müller, Peter (University of Munich)

Nachtergaele, Bruno (UC, Davis)
Nguyen, Son T (University of Missouri)
Ogata, Yoshiko (Tokyo University)
Pal, Arijeet (Harvard University)
Sadel, Christian (University of British Columbia)
Schenker, Jeffrey (Michigan State University)
Schlein, Benjamin (Bonn University)
Schmidt, Daniel (Virginia Tech)
Seiringer, Robert (McGill University)
Shamis, Mira (Princeton University)
Sims, Robert (University of Arizona)
Sodin, Sasha (Princeton University)
Starr, Shannon (University of Alabama, Birmingham)
Stolz, Gunter (University of Alabama, Birmingham)
Tsang, Chi Shing Sidney (UC, Irvine)
Virag, Balint (University of Toronto)
Warzel, Simone (Technical University of Munich)
Yngvason, Jakob (University of Vienna)
Zagrebnov, Valentin (Laboratoire d'Analyse Topologie et Probabilités)

Axiomatic Approaches to Forcing Techniques in Set Theory

November 3-8, 2013

Organizers:

Matthew Foreman (UC, Irvine)
Justin Moore (Cornell University)

Stevo Todorcevic (University of Toronto)



The focus of this program was on forcing axioms and their applications within mathematics. Forcing axioms are strong Baire category assumptions which are not provable or refutable from the commonly accepted axioms of mathematics and which serve as a unified framework for settling the status of problems arising in other areas of mathematics. In conjunction with assumptions such as the Continuum Hypothesis and Gödel's Axiom of Constructability, they can be used to establish many if not most of the current independence results. The program brought senior leaders in the field together with students and junior researchers to study further applications of these methods.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5026>

Participants:

Aviles, Antonio (Universidad de Murcia)
Bleak, Collin (University of St Andrews)
Brech, Christina (University of São Paulo)
Fischer, Vera (Kurt Godel Research Center)
Foreman, Matthew (UC, Irvine)
Haydon, Richard (University of Oxford)
Hill, Aaron (University of North Texas)
Jasinski, Jakub (University of Calgary)
Koszmider, Piotr (Polish Academy of Sciences)
Lopez-Abad, Jordi (Instituto de Ciencias Matemáticas)

Moore, Justin (Cornell University)
Mota, Miguel Angel (University of Toronto)
Neeman, Itay (UC, Los Angeles)
Sabok, Marcin (McGill University)
Sapir, Mark (Vanderbilt University)
Solecki, Slawomir (University of Illinois at Urbana-Champaign)
Todorcevic, Stevo (University of Toronto)
Tyros, Konstantinos (University of Toronto)
Weiss, Benjamin (Hebrew University of Jerusalem)
Yorioka, Teruyuki (Shizuoka University)

Computable Model Theory

November 3-8, 2013

Organizers:

Barbara Csima (University of Waterloo)

Sergey Goncharov (Sobolev Institute of Mathematics)

Noam Greenberg (Victoria University of Wellington)

Julia Knight (University of Notre Dame)

Antonio Montalban (UC, Berkeley)

Theodore Slaman (UC, Berkeley)



Children learn in school how to add and multiply whole numbers, perform long division, and so on. Putting educational development aside, computability theory tells us that this time is wasted: these tasks can be effectively carried out by computers. There are recipes, or emph{algorithms}, that can be mechanically followed by a non-sentient being such as a computer, for performing these computations. However, later in their schooling, students study Euclidean geometry. Rather than mechanically compute, they now require imagination to find proofs for theorems about lines and angles, circles and squares. This time, computability theory delivers a different verdict on the efforts of the educational system: a computer cannot have insight into absolute knowledge of geometry; the human endeavor of finding geometric proofs is inherently creative. Algebraists generalise the arithmetic operations on whole numbers to construct a plethora of structures. Among them are collections of more complicated numbers, symmetries of mathematical objects, and objects that measure relatedness, such as graphs. The role of computable model theory is to examine these structures and constructions through a computable lens. Which of the algebraic objects can be built by a computer? If they cannot be, what kind of non-computable information (such as all geometric truth) may these objects be coding? When is one structure more complicated than another?

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5047>

Participants:

Andrews, Uri (University of Wisconsin-Madison)

Belanger, David (Cornell University)

Csima, Barbara (University of Waterloo)

Fokina, Ekaterina (Kurt Goedel Institute Vienna)

Greenberg, Noam (Victoria University of Wellington)

Hirschfeldt, Denis (University of Chicago)

Kalimullin, Iskander (Kazan Federal University)

Khoussainov, Bakhadyr (University of Auckland)

Knight, Julia (University of Notre Dame)

Lange, Karen (Wellesley College)

Lempp, Steffen (University of Wisconsin-Madison)

Melnikov, Alexander (Victoria University of Wellington)

Miller, Russell (Queens College (City University of New York))

Montalban, Antonio (UC, Berkeley)

Morozov, Andrey (Sobolev Institute of Mathematics)

Puzarenko, Vadim (Sobolev Institute of Mathematics)

Slaman, Theodore (UC, Berkeley)

Solomon, David Reed (University of Connecticut)

Steiner, Rebecca (Vanderbilt University)

Turetsky, Dan (Kurt Goedel Research Centre)

Creative Writing in Mathematics and Science

November 10-15, 2013

Organizers:

Florin Diacu (University of Victoria)

Marjorie Senechal (Smith College)



This workshop was concerned with writing about mathematics and science and giving the general public the chance to have a glimpse at our world without having to become experts. It was about the achievements and the beauty of mathematics and science, and the struggle to understand the problems we are working on. It aimed to bring together both established and young mathematicians and scientists who also write about their field, exchange ideas and find new and ingenious ways to reach the general public through creative writing.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5014>

Participants:

Anand, Madhur (University of Guelph)
Bonny, Sandy Marie (University of Saskatchewan)
Chapman, Robin (University of Wisconsin)
Dawson, Robert (St. Mary's University)
Diacu, Florin (University of Victoria)
Dickinson, Adam (Brock University)
Elran, Yossi (Davidson Institute of Science Education and Weizmann Institute of Science)
Fox, Josy (Independent Writer)
Goodman, Jacob E. (City College, City University of New York)
Grosholz, Emily (Pennsylvania State University)

Growney, JoAnne (Mathematics and Poetry)
Holmes, Philip (Princeton University)
Ingram, Patrick (Colorado State University)
Karaali, Gizem (Pomona College)
Mazur, Joseph (Marlboro College)
Merow, Katharine (Mathematical Association of America)
O'Shea, Donal (New College of Florida)
Roberts, Siobhan (Siobhan Roberts)
Sangalli, Arturo (The Writers' Union of Canada)
Senechal, Marjorie (Smith College)
Szpiro, George (Neue Zuercher Zeitung)

Current Challenges for Mathematical Modelling of Cyclic Populations

November 10-15, 2013

Organizers:

Jonathan Sherratt (Heriot-Watt University)

Hao Wang (University of Alberta)

Rebecca Tyson (University of British Columbia Okanagan)



The organizers brought together ecologists and mathematicians with expertise in cyclic populations to discuss recent advances in our theoretical understanding of the causes and implications of population cycles from both the ecological and mathematical points of view. The main scientific objectives of the workshop were: 1) to bring mathematicians and ecologists together to address, from theoretical and experimental points of view, the mathematical questions surrounding persistence, spread and management of cyclic populations in dynamic landscapes and 2) to stimulate mathematical investigations and field experiments addressing these questions in ways that maximize the potential synergies between the disciplines of mathematics and ecology.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5151>

Participants:

Abbott, Karen (Case Western Reserve University)

Barraquand, Frédéric (University of Tromsø)

Campbell, David (Simon Fraser University)

Cobbold, Christina (University of Glasgow)

Cordoleani, Flora (UC, Davis)

DeAngelis, Don (University of Miami)

Elder, Bret (Louisiana State University)

Fox, Jeremy (University of Calgary)

Greenwood, Priscilla (University of British Columbia)

Hilker, Frank (University of Bath)

Kong, Jude (University of Alberta)

Louca, Stilianos (University of British Columbia)

Lutscher, Frithjof (University of Ottawa)

Murray, Dennis (Trent University)

Stieha, Chris (Cornell University)

Taylor, Rachel (Heriot-Watt University)

Tyson, Rebecca (University of British Columbia Okanagan)

Vitense, Kelsey (University of Washington)

Wolkowicz, Gail S.K. (McMaster University)

Zhu, Huaiping (York University (Canada))

Entanglement in Biology; How Nature Controls the Topology of Proteins and DNA

November 17-22, 2013

Organizers:

Kenneth Millett (UC, Santa Barbara)
Eric Rawdon (University of Saint Thomas)
Christine Soteris (University of Saskatchewan)

Andrzej Stasiak (University of Lausanne)
Joanna Sulkowska (University of Warsaw)



This workshop focused on the mathematics associated with a specific array of cutting edge problems arising from molecular biology studies of proteins, DNA, and other biopolymers that show promise for immediate progress. The timing, Spring 2013, served as a launching pad for the research of some carefully chosen graduate students, post-docs, and new professors who were invited to participate.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5133>

Participants:

Arsuaga, Javier (San Francisco State University)
Buck, Dorothy (Imperial College)
Buck, Greg (Saint Anselm College)
Cantarella, Jason (University of Georgia)
Catanese, Jr, Daniel J. (Baylor College of Medicine)
Cieplak, Marek (Polish Academy of Science)
Darcy, Isabel (University of Iowa)
De Sanctis, Bianca (University of Calgary)
Deguchi, Tetsuo (Ochanomizu University)
Diao, Yuanan (University of North Carolina)
Dietler, Giovanni (École polytechnique fédérale de Lausanne)
Ernst, Claus (Western Kentucky University)
Haglund, Ellinor (UC, San Diego and The Center for Theoretical Biological Physics)
Harris, Sarah (University of Leeds)
Jackson, Sophie (University of Cambridge)
Janse van Rensburg, Esaias J (York University)
Kadomatsu Hermosa, Maridian José (Facultad Politécnica)
Li, Hongbin (University of British Columbia)
Micheletti, Cristian (International School for Advanced Studies)
Millett, Kenneth (UC, Santa Barbara)
Minor, Wladek (University of Virginia)

Myers, Christopher (University of Texas Medical Branch and Baylor College of Medicine)
Onuchic, Jose (Rice University)
Panagiotou, Eleni (National Technical University of Athens)
Plotkin, Steven (University of British Columbia)
Price, Candice (United States Military Academy, West Point)
Rawdon, Eric (University of Saint Thomas)
Rechnitzer, Andrew (University of British Columbia)
Scharein, Rob (Hypnagogic Software)
Schmirler, Matthew (University of Saskatchewan)
Schwartzman, Jorge (Centro de Investigaciones Biológicas)
Shimokawa, Koya (Saitama University)
Soteris, Christine (University of Saskatchewan)
Stasiak, Andrzej (University of Lausanne)
Sulkowska, Joanna (University of Warsaw)
Summers, DeWitt (Florida State University)
Szafron, Michael (University of Saskatchewan)
Szymczak, Piotr (University of Warsaw)
Valencia, Karin (Imperial College London)
Vazquez, Mariel (San Francisco State University)
Virnau, Peter (Johannes Gutenberg-Universität Mainz)
Whittington, Stuart (University of Toronto)

Understanding Relationships between Aboriginal Knowledge Systems, Wisdom Traditions, and Mathematics: Research Possibilities

November 24-29, 2013

Organizers:

Edward Doolittle (First Nations University of Canada) **Florence Glanfield** (University of Alberta)



Following dialogues within each of three Aboriginal communities sponsored by SSHRC grant # 856-2009-0038, the purpose of this 5-day workshop was to: 1) provide an opportunity for Aboriginal communities and Aboriginal and non-Aboriginal scholars to engage in dialogue around the value of mathematics education to Aboriginal peoples of Canada; 2) develop a shared understanding of the way in which different Aboriginal knowledge systems and wisdom traditions might inform and be understood in relation to Eurocentric knowledge systems and wisdom traditions in mathematics education; 3) develop research questions and proposals that will inform mathematics education policies and practices that will contribute to the success of Aboriginal youth in Canada; and 4) formalize a research partnership among and between Blackfoot and Cree communities and post-secondary institutions.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5120>

Participants:

Cardinal Collins, Mary (University of Alberta)
Cunningham, Joanne (Horizon School Division)
Donald, Dwayne (University of Alberta)
Doolittle, Edward (First Nations University of Canada)
Ealey, Ken (Alberta Education)
Glanfield, Florence (University of Alberta)
Klassen, Diana (University of Manitoba)

Lunney Borden, Lisa (St Francis Xavier University)
McKenna, Betty (First Nations University of Canada)
McNabb, Shannon (First Nations University of Canada)
Russell, Gale (University of Saskatchewan)
Wiebe Buchanan, Christine (University of Alberta)
Wiseman, Dawn (University of Alberta)

Operator Algebras and Dynamical Systems from Number Theory

November 24-29, 2013

Organizers:

Alan Carey (Australian National University)

Marcelo Laca (University of Victoria)



In recent years, there have been several exciting and promising developments on the interplay between number theory and noncommutative geometry/operator algebras/dynamical systems. The program has moved forward in several key directions, there are now several junior researchers who have been trained specifically on the subject and, moreover some established researchers from either area have become involved and made contributions to the subject. This workshop aimed to: 1) to bring together a fairly diverse group of researchers with expertise in the different strands of the field in order to spark new ideas and directions; 2) to promote an efficient exchange of the recent results so that they can be interpreted from the various perspectives; and 3) to provide an opportunity to researchers entering the field (either early career or established ones who are reaching out to this area) to share their results and keep abreast of recent developments.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/5-day-workshops/13w5152>

Participants:

an Huef, Astrid (University of Otago)
Brenken, Berndt (University of Calgary)
Brownlowe, Nathan (University of Wollongong)
Bruce, Chris (University of Victoria)
Carey, Alan (Australian National University)
Cornelissen, Gunther (Utrecht University)
Cuntz, Joachim (University of Muenster)
Duwenig, Anna (University of Victoria)
Echterhoff, Siegfried (Mathematisches Institut, Universität Münster)
Karemaker, Valentijn (Utrecht University)

Katsoulis, Elias (East Carolina University)
Khalkhali, Masoud (University of Western Ontario)
Laca, Marcelo (University of Victoria)
Larsen, Nadia (University of Oslo)
Li, Xin (Queen Mary University of London)
Phillips, John (University of Victoria)
Raeburn, Iain (University of Otago)
Rennie, Adam (University of Wollongong)
Sims, Aidan (University of Wollongong)
Stammeier, Nicolai (University of Muenster)
Trifkovic, Mak (University of Victoria)

Banff International Research Station

2013

2-Day Workshops

Ted Lewis Workshop on SNAP Math Fairs 2013

April 26-28, 2013

Organizers:

Sean Graves (University of Alberta)
Tiina Hohn (MacEwan University)

Ted Lewis (SNAP Mathematics Foundation)

SNAP math fairs are non-competitive events that give teachers an opportunity to have their students do problem solving with a particular goal in mind. The Ted Lewis SNAP Math Fair Workshop was a gathering of teachers and educators who had a common interest in promoting and learning about hosting SNAP Math Fairs. The experienced teachers shared their success stories in hopes to motivate others to adopt SNAP Math Fairs into their classrooms.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2175>

Participants:

Cooke, Mike (Princess Margaret Secondary School)
Francis-Poscente, Krista (University of Calgary)
Graves, Sean (University of Alberta)
Hoffman, Janice (Edmonton Public Schools)
Hohn, Tiina (MacEwan University)
Jones, Carolyn (Dr. Donald Massey School)
Kotyk, Nicole (Evergreen Elementary School)
Lewis, Ted (SNAP Mathematics Foundation)
Liu, Andy (University of Alberta)

Morgan-Manchuk, Amber (St. Anne Elementary ECSD)
Morrill, Ryan (University of Alberta)
Pasanen, Trevor (University of Alberta)
Radomski, Stephanie (St. Anne Elementary ECSD)
Shields, Jon (Campus St.Jean)
Swan, Amanda (University of Alberta)
Thompson, Tanya (ThinkFun, Inc)
Varughese, Betsy (University of Alberta)

Alberta Number Theory Days 2013

May 10-12, 2013

Organizers:

Brandon Fodden (University of Lethbridge)

David Roe (University of Calgary)



“Number theory” is perhaps a surprising name for a branch of mathematics, since you could be forgiven for thinking that all mathematics was about numbers. In fact, number theorists are those mathematicians who are interested in whole numbers: 1, 2, 3, 4 and so on. Yet how could numbers which appear so simple on face value be of any interest at all? Appearances are as deceptive in mathematics as they can be in real life, since some of the greatest mathematical problems today are about the whole numbers. For example, it was only about fifteen years ago that the three-and-a-half century old Fermat’s Last Theorem was finally proven, even though the statement of the theorem can be understood by anyone who knows how to add and multiply two numbers together. This lively and far-reaching mathematical discipline is as useful as it is challenging: Every credit card transaction, every email sent, relies upon number theory to ensure it is transmitted securely. Alberta is home to a number of very active groups of number theorists, but with hours of driving separating them it can sometimes be hard to discuss ideas. This was the rationale to come together for the workshop at BIRS: to exchange thoughts, plan projects, and forge links to ensure that Alberta continues to be a leading contributor to number theory.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2179>

Participants:

Akbary, Amir (University of Lethbridge)
Aryan, Farzad (University of Lethbridge)
Bauer, Mark (University of Calgary)
Bedard, Robert (University of Lethbridge)
Bleaney, Jeff (University of Lethbridge)
Cunningham, Clifton (University of Calgary)
Doran, Charles (University of Alberta)
Elkies, Noam (Harvard University)
Felix, Adam (University of Lethbridge)
Fenton, Diane (University of Calgary)
Fodden, Brandon (University of Lethbridge)
Guy, Richard (University of Calgary)
Jacobson, Michael (University of Calgary)
Kadiri, Habiba (University of Lethbridge)
Kumar, Manoj (University of Lethbridge)

Langlois, Marie-Andree (University of Calgary)
Lindner, Sebastian (University of Calgary)
Liprandi, Max (University of Calgary)
Lumley, Allysa (University of Lethbridge)
Ng, Nathan (University of Lethbridge)
Reid, Samuel (University of Calgary)
Rezai Rad, Monireh (University of Calgary)
Roe, David (University of Calgary)
Scheidler, Renate (University of Calgary)
Sylvestre, Jeremy (University of Alberta)
Thom, Mark (University of Lethbridge)
Weir, Colin (University of Calgary)
Yazdani, Soroosh (University of Lethbridge)
Zvengrowski, Peter (University of Calgary)

A Scientific Retreat for Mathematical Scientists from Western Canada July 19-21, 2013

Organizers:

Alejandro Adem (Pacific Institute for the
Mathematical Sciences)

Do-Rim Joo (Pacific Institute for the Mathematical
Sciences)

At this event a group of mathematical scientists from universities in Alberta, British Columbia, Saskatchewan and Washington State met to strategize and coordinate future collaborations in Western Canada. BIRS offered an ideal setting for blue sky discussions and active interactions during the entire duration of the event.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2188>

Participants:

Adem, Alejandro (Pacific Institute for the
Mathematical Sciences)
Akbary, Amir (University of Lethbridge)
Barlow, Martin (University of British Columbia)
Bingham, Derek (Simon Fraser University)
Cunningham, Clifton (University of Calgary)
Doran, Charles (University of Alberta)
Farenick, Douglas (University of Regina)
Frigaard, Ian (University of British Columbia)
Homsy, G. M. (Bud) (University of British Columbia)
Janssen, Jeannette (Dalhousie University)

Laca, Marcelo (University of Victoria)
Lamoureux, Michael (University of Calgary)
Lind, Douglas (University of Washington)
Perkins, Ed (University of British Columbia)
Pevtsova, Julia (University of Washington)
Pianzola, Arturo (University of Alberta)
Soteros, Christine (University of Saskatchewan)
Srinivasan, Raj (University of Saskatchewan)
Stanley, Don (University of Regina)
Thompson, Mary (University of Waterloo)
Vatsal, Vinayak (University of British Columbia)

Inexact Optimization Theory for Resources and Environmental Management

August 2-4, 2013

Organizers:

Gordon Huang (University of Regina)

Wei Sun (International Society for Environmental Information Sciences)

This workshop aimed to introduce recent advances in integrated inexact optimization methodologies for addressing various forms of uncertainties associated with resources and environmental management systems. A number of compound approaches which had improved upon the conventional inexact optimization approaches with advantages in terms of uncertainty reflection, policy analysis and dynamic analysis were investigated and their potential application to various cases were discussed.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2178>

Participants:

Chen, Xi (Hohai University)

Chen, Xiaohong (Zhongshan University)

Chen, Guanhui (University of Regina)

Guo, Ping (China University of Agriculture)

Han, Jingcheng (North China Electrical Power University)

Hu, Hongchang (Tsinghua University)

Huang, Gordon (University of Regina)

Huang, Qiang (Xi'an University of Technology)

Huang, Kai (International Society for Environmental Information Sciences)

Khan, Usman (University of Victoria)

Li, Wanhong (National Natural Science Foundation of China)

Li, Yongping (North China Electrical Power University)

Li, Keely (University of Regina)

Li, Jianbing (University of Northern British Columbia)

Liang, Zhongmin (Hohai University)

Liao, Rafael (University of Regina)

Ni, Guangheng (Tsinghua University)

Shi, Peng (Hohai University)

Siddhartho Shekhar, Paul (University of Northern British Columbia)

Sun, Wei (International Society for Environmental Information Sciences)

Wang, Xiuquan (International Society for Environmental Information Sciences)

Wang, Mengyuan (Petroleum Technology Research Center)

Xiong, Lihua (Wuhan University)

Ye, Lin (Xi'an University of Technology)

Zhao, Shan (University of Regina)

Statistics and Triggering of Earthquakes

August 30-September 1, 2013

Organizers:

Yehuda Ben-Zion (University of Southern California) **Robert Shcherbakov** (University of Western Ontario)
Joern Davidsen (University of Calgary)

The main goal of the workshop was to build and strengthen newly emerging links between active research groups in different scientific areas – statistics/probability, mathematics, physics, geodesy and seismology – toward achieving improved predictive understanding of seismicity patterns and structures and a physical theory for earthquake dynamics. The workshop highlighted the key role of the mathematical sciences in studying seismicity dynamics in relation to properties of faults and the crust as an essential component of this interdisciplinary research endeavor. The participant list reflects this diversity and includes senior and junior experts from different scientific areas. The ever-increasing threat to humanity from earthquakes in industrial and highly populated areas prompts for active cross-disciplinary earthquake research and justified the necessity of this focused workshop. The workshop was organized as a part of the international program, Mathematics of Planet Earth 2013, under the auspices of Banff International Research Station with support from the International Union of Geodesy and Geophysics (via the Commission on Mathematical Geophysics, President: Y. Ben-Zion).

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2171>

Participants:

Ben-Zion, Yehuda (University of Southern California)
Davidsen, Joern (University of Calgary)
Durand, Virginie (CNRS)
Eaton, David W. (University of Calgary)
El-Isa, Zuhair Hasan (University of Calgary and University of Jordan)
Fineberg, Jay (The Hebrew University of Jerusalem)
Grob, Melanie (University of Alberta)
Johnson, Paul (LANL)
Johnson, Christopher (UC Berkeley)
Mahani, Alireza (University of Calgary)
Meng, Xiaofeng (Georgia Tech)
Moradpour Taleshi, Javad (University of Calgary)

Naylor, Mark (University of Edinburgh)
Pankow, Kristine (University of Utah)
Rosenberger, Andreas (NR Canada)
Ross, Zachary (University of Southern California)
Sattari, Arsalan (University of Calgary)
Shcherbakov, Robert (University of Western Ontario)
van der Elst, Nicholas (Lamont-Doherty Earth Observatory)
Velasco, Aaron (The University of Texas at El Paso)
Zaliapin, Ilya (University of Nevada)
Zhang, Xiaoming (University of Western Ontario)
Zigone, Dimitri (University of Southern California)

Recent Progress on Applied and Computational Harmonic Analysis

August 30-September 1, 2013

Organizers:

Elena Braverman (University of Calgary)
Bin Han (University of Alberta)

Ozgur Yilmaz (University of British Columbia)

The workshop provided a forum for collaborative research group members and especially for associated postdoctoral fellows and graduate students to report the most recent results and exchange ideas. It concentrated on recent advances in applied and computational harmonic analysis, in particular, on next generation novel efficient mathematical multiscale representation methods and fast computational algorithms to meet the ever increasingly challenging tasks arising from many areas of sciences and applications. More specifically, focussing on multiscale based methods and redundant representations, consisting of the following three closely related and integrated parts: 1) subdivision schemes and multiresolution structure with applications in applied mathematics, geometric data analysis, and visualization/simulation in computer graphics; 2) Riesz wavelets in numerical solutions to partial differential equations (PDEs) including Riesz wavelets in bounded domains with nonuniform meshes and adaptive wavelet multiscale methods for numerical solutions to PDEs; and 3) redundant representation in signal/image processing including development of SigmaDelta schemes for analog-to-digital conversion and applications of directional wavelet frames in digital image/signal processing coupled with Bregman iteration algorithm and optimization techniques.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2187>

Participants:

Au-Yeung, Enrico (University of British Columbia)
Braverman, Elena (University of Calgary)
Butaev, Almaz (Concordia University)
Duchamp, Tom (University of Washington)
Ghadermarzi, Navid (University of British Columbia)
Han, Bin (University of Alberta)
Lai, Chun-Kit (McMaster University)

MacArthur, Joshua (Dalhousie University)
Melnykova, Kateryna (University of British Columbia)
Shen, Yi (University of Alberta)
Sun, Qiyu (University of Central Florida)
Yilmaz, Ozgur (University of British Columbia)
Yu, Thomas (Drexel University)
Zhao, Zhenpeng (University of Alberta)

Workshop on Stochasticity in Biochemical Reaction Networks

September 13-15, 2013

Organizers:

Alistair Boettiger (Harvard University)

Mary Dunlop (University of Vermont)

Robert Egbert (UC, Berkeley)

Andrew Mugler (FOM Institute AMOLF)

All the chemical processes that are essential for life --- basic metabolism, cell division, cell growth --- are driven on the molecular scale by the random interaction of their chemical constituents. When the number of interactions is relatively small, as is often the case in cells, substantial deviations from the average behavior can be observed in the population --- in the same way that the fraction of heads when flipping a coin may deviate substantially from one half if it is flipped only a few times. Processes that have this sort of non-deterministic outcome are called "stochastic." Understanding how stochastic variation affects cellular behaviors and uncovering how biological processes can either exploit or minimize this variability has implications for many areas of research, from human disease and regenerative medicine, to molecular computing and nanotechnology. This workshop united researchers from across these fields to share insights into the role and control of stochasticity in biochemical systems. They shared new mathematical, statistical, and quantitative experimental techniques to help us understand and make predictions about stochastic biological systems. Developing a mathematical understanding of the stochastic behaviors of life would be a key chapter in the Mathematics of Planet Earth.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2162>

Participants:

Abel, Steve (University of Tennessee)

Altschuler, Steven (University of Texas Southwestern Medical Center)

Assaf, Michael (Hebrew University of Jerusalem)

Boettiger, Alistair (Harvard University)

Drees, Bastian (University of Heidelberg)

Egbert, Robert (UC, Berkeley)

Franco, Elisa (UC, Riverside)

Golding, Ido (Baylor College of Medicine)

Khammash, Mustafa (ETH Zurich)

Komorowski, Michal (Polish Academy of Sciences)

Kondev, Jane (Brandeis University)

Maheshri, Narendra (Massachusetts Institute of Technology)

Mehta, Pankaj (Boston University)

Moffitt, Jeffrey (Harvard University)

Mugler, Andrew (FOM Institute AMOLF)

Paulsson, Johan (Harvard University)

Potvin-Trottier, Laurent (Harvard University)

Raj, Arjun (University of Pennsylvania)

Read, Elizabeth (UC, Irvine)

Reuveni, Shlomi (Harvard University)

Seelig, Georg (University of Washington)

Shvartsman, Stanislav (Princeton University)

ten Wolde, Pieter Rein (AMOLF)

Xiao, Jie (John Hopkins University School of Medicine)

Youk, Hyun (UC, San Francisco)

Zenklusen, Daniel (Université de Montréal)

Zimmer, Christoph (University of Heidelberg)

The Science of Network Coding

September 20-22, 2013

Organizers:

Michael Langberg (State University of New York at Buffalo) **Zongpeng Li** (University of Calgary)

Departing from the de facto standard of store-and-forward data networking, network coding is a new technique from information theory that encourages the mixing of information within a network. Since its proposal in 2000, this new subject has immediately attracted a substantial amount of attention from both information theory and computer science. Besides being envisioned to revolutionize the way information is communicated in the future, network coding has proven to be a fertile ground where new computer science problems can be defined, and where new tools can be designed for classic computer science problems. The workshop provided a unique venue for the two groups of experts to meet face to face, for the two schools of thoughts to collide, for even more remarkable ideas and results to be discovered, jointly.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2169>

Participants:

Bakshi, Mayank (Chinese University of Hong Kong)
Effros, Michelle (California Institute of Technology)
El-Rouayheb, Salim (Illinois Institute of Technology)
Fragouli, Christina (École polytechnique fédérale de Lausanne and UC, Los Angeles)
Ho, Tracey (California Institute of Technology)
Hu, Yaochen (University of Alberta)
Jaggi, Sidharth (Sid) (The Chinese University of Hong Kong)
Khabbajian, Majid (University of Alberta)

Kim, Young-Han (UC, San Diego)
Kliewer, Joerg (New Mexico State University)
Langberg, Michael (State University of New York, Buffalo)
Li, Zongpeng (University of Calgary)
Liu, Yang (University of Calgary)
Niu, Di (University of Alberta)
Ramamoorthy, Aditya (Iowa State University)
Sprintson, Alex (Texas A & M University)
Yin, Xunrui (University of Calgary)
Zhao, Yao (University of Calgary)

Mathematical Modeling of Indigenous Populations Health

September 27-29, 2013

Organizers:

Michael Li (University of Alberta)
Seyed Moghadas (York University)

Beate Sander (Public Health Ontario and University of Toronto)
Jianhong Wu (Centre for Disease Modeling, York University)

The workshop built on past collaborative efforts established at the 2012 Centre for Disease Modelling workshop on Indigenous Populations Health Protection, to further explore strategies for optimizing health responses to the threats of emerging infectious diseases. While not a fully exhaustive list, reasons for the disproportionate effects of the 2009 influenza H1N1 had been identified as the prevalence of pre-disposing health conditions, limited access to healthcare, and various historical considerations. Understanding the role of these factors in disease spread posed significant challenges but at the same time presented opportunities for developing appropriate and novel mathematical models, theoretical frameworks, and technologies that led to well informed public health policy decisions. It was important that these efforts be conducted in a truly interdisciplinary fashion, involving stakeholders, public health policy decision makers, surveillance and health informatics experts, computer scientists, statisticians and mathematicians, so as to ensure that a correct understanding of the relationship between vulnerability, risk factors, and within-community factors (e.g., age distribution, multigenerational household, crowded living conditions, and other demographic variables as well as transportation) were reached.

The workshop was a timely event for the dissemination of new knowledge generated to-date by synthesizing the best available data in modelling endeavours and sharing findings of public health significance. The workshop heard from stakeholders and policy makers involved in Indigenous health to ensure that the target messages were delivered and the practical aspects of newly generated knowledge were discussed. Taken together, this knowledge has led to useful strategies that move us from evidence to action and facilitate future directions for collaborative efforts.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2111>

Participants:

Altman, Eleonora (National Research Council Canada)
Arino, Julien (University of Manitoba)
Charania, Nadia (University of Waterloo)
Driedger, Michelle (University of Manitoba)
Fisman, David (University of Toronto)
Kettner, Joel (National Collaborating Centre for Infectious Diseases)
Laskowski, Marek (York University)
Li, Michael (University of Alberta)
Moghadas, Seyed (York University)
Morrison, Kathryn (McGill University)

Pizzi, Nick (University of Manitoba)
Richardson, Katya (York University)
Singh, Bismark (The University of Texas at Austin)
Smylie, Janet K. (Saint Michael's Hospital)
Sobol, Isaac (Health Canada)
Sutherland, Don (Consultant Global Public Health)
Ulanova, Marina (Northern Ontario School of Medicine)
Varughese, Betsy (University of Alberta)
Xiao, Yanyu (York University)
Yan, Ping (Public Health Agency of Canada)

International Graduate Training Centre in Mathematical Biology Summit November 8-10, 2013

Organizers:

Daniel Coombs (University of British Columbia)

The International Graduate Training Centre (IGTC) organizes graduate training in mathematical and computational biology across British Columbia and Alberta universities through student fellowships and support of student-oriented activities such as summer schools and conferences. The IGTC is currently supported by the Pacific Institute for Mathematical Sciences, and mPrime. A core activity of the IGTC is the annual graduate student summit. This year the IGTC held the summit at BIRS. This year's summit included: 1) professional development activities; 2) opportunities for students to present their original research and receive feedback from faculty members and peers from across the network; 3) technical instruction and research presentations by invited speakers.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2190>

Participants:

Akinwumi, Michael (University of Alberta)

Allard, Jun (UC, Irvine)

Bampfylde, Caroline (Government of Alberta)

Buttenschoen, Andreas (University of Alberta)

Campbell, David (Simon Fraser University)

Chkrebti, Oksana (Simon Fraser University)

Cobbold, Christina (University of Glasgow)

Contreras, Carlos (University of Alberta)

Coombs, Daniel (University of British Columbia)

Culos, Garrett (University of Victoria)

David, Jummy (University of British Columbia)

Du, Peng (University of Alberta)

Edelstein-Keshet, Leah (University of British Columbia)

Fassnacht, Susan (University of British Columbia)

Foxall, Eric (University of Victoria)

Herrera, Alejandra (University of British Columbia)

Hillen, Thomas (University of Alberta)

Iqbal, Muhammad Sajid (University of Lethbridge)

Knutsdottir, Hildur (University of British Columbia)

Konrad, Bernhard (University of British Columbia)

Lewis, Mark (University of Alberta)

Louca, Stilianos (University of British Columbia)

Mata, May Anne (University of British Columbia
Okanagan)

Olobatuyi, Oluwole Victor (University of Alberta)

Rajaraman, Ashok (Simon Fraser University)

Su, Zhimin (University of Alberta)

Swan, Amanda (University of Alberta)

Tyson, Rebecca (University of British Columbia
Okanagan)

van den Driessche, Pauline (University of Victoria)

Veljee, Wafa (University of Alberta)

White, Diana (University of Alberta)

Wu, Tenghu (University of British Columbia)

Xu, Chuang (University of Alberta)

Zhong, Xiaojing (University of Alberta)

K-12 Unsolved

November 15-17, 2013

Organizers:

Gordon Hamilton (MathPickle.com)

James Tanton (Mathematical Association of America)

K-12 teachers struggle every day with how to engage a large spectrum of student ability. When a grade 2 teacher starts to teach addition, she knows that the top students in her class already know how to add, while the bottom students are still struggling with yesterday's ideas. How can she engage the top students without losing the bottom students? How can she engage the bottom students without boring the top students? This workshop recommended thirteen curricular unsolved problems that belong in every child's experience of mathematics. Struggling students got the practice they needed working on basic skills. Top students were inspired because the hard problems were worthy of their intellects. See YouTube videos of unsolved problems in real classrooms: [http://mathpickle.com/\\$1,000,000_Problems.html](http://mathpickle.com/$1,000,000_Problems.html).

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/2-day-workshops/13w2173>

Participants:

Auckly, Dave (Kansas State University)

Carlgren, Dave (Renert School and University of Calgary)

Chapman, Olive (University of Calgary)

Conrey, John Brian (American Institute of Mathematics)

Guy, Richard (University of Calgary)

Hamilton, Gordon (MathPickle.com)

James, Gael (River Valley School)

Kornoely, Jason (Pine Ridge Elementary School
Grand Rapids Michigan)

Ling, Joseph (University of Calgary)

Lorway, Geri (Thinking 101)

Matson, Anya (Racine Math Circle)

Pegg, Ed (MathPuzzle.com)

Picciotto, Henri (Henri Picciotto's Math Education Page)

Pinter, Gabriella (University of Wisconsin Milwaukee)

Preciado, Paulino (Galileo Educational Network
Association)

Rabinovich, Cindy-Sue (Renert School)

Renert, Aaron (Calgary Bright Minds)

Renert, Moshe (Renert School, UBC, University of
Calgary)

Robichaud, Zaak (Bears paw Christian School)

Serenevy, Amanda (Riverbend Community Math Center)

Sirotic, Natasa (Southpointe Academy)

Sirotic, Diana (Math Potentials)

Tanton, James (Mathematical Association of America)

Vikairaghavan, Rakhee (Crossing Park School)

Woodrow, Robert (University of Calgary)

Zeitz, Paul (University of San Francisco)

Zucker, Joshua (Julia Robinson Mathematics Festival)

Banff International Research Station

2013

**Summer Schools
Research in Teams
Focussed Research Groups**

Summer Schools

2013 Summer IMO Training Camp July 7-21, 2013

Organizers:

Robert Morewood (YWorld.com)



The International Mathematical Olympiad (IMO) is the “world championship” of high school math contests. It is held every year somewhere in the world, with Canada and up to 100 other countries each sending up to six high school students to compete. The contest lasts two days, and on each day the students are given three very tough math problems to solve within 4 1/2 hours. The IMO Training Camp is an intensive two-week preparation for the six Canadian students attending the upcoming International Mathematical Olympiad, plus several adult trainers. Once again this year, the camp took place at BIRS. Here, our six-student team received intensive training in the form of practice contests and lectures.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/summer-schools/13ss013>

Participants:

Deng, Calvin (International Mathematical Olympiad)
Furmaniak, Ralph (Stanford University)
Karp, Steven (International Mathematical Olympiad)
Ma, John (International Mathematical Olympiad)
Morewood, Robert (YWorld.com)
Recio, Felix (University of Toronto)

Song, Zhuo Qun (Alex) (International Mathematical Olympiad)
Spivak, Daniel (International Mathematical Olympiad)
Sun, Kevin (Kennedy Jr. High)
Whatley, Alexander (International Mathematical Olympiad)
Yazdani, Soroosh (University of Lethbridge)

Research in Teams

Estimates for Denominators of Padé Approximants and Applications to Diophantine Equations April 28-May 5, 2013

Organizers:

Michael Bennett (University of British Columbia)
Greg Martin (University of British Columbia)

Kevin O'Bryant (City University New York)

Padé approximants are an old tool that are extensively used in many areas of mathematics, but in number theory, are still poorly understood 100 years later. This research team aimed to finish the old problem of determining the asymptotics of this machinery as it was applied in number theory. This problem required bringing together experts in Diophantine analysis, analytic number theory and combinatorics. If successful, this project will have numerous applications to such classical problems as the gaps between k th power free integers.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/research-in-teams/13rit174>

Cholera Dynamics on Community Networks August 4-11, 2013

Organizers:

Zhisheng Shuai (University of Central Florida)
Joseph Tien (Ohio State University)

Pauline van den Driessche (University of Victoria)

Suppose that we have a set of communities, connected together by a network such as a waterway or road. When can a disease invade this network? If it can invade, what are the resulting disease dynamics? The answers to these questions should intuitively depend upon both the community characteristics (e.g. population density, sanitation, health care services in a given community) and the network structure. This project investigated this in the context of cholera, which has drawn much recent attention due to severe outbreaks in Haiti, West Africa, Zimbabwe, and elsewhere. Preliminary results indicate that the network structure and patch characteristics combine in elegant ways to govern the ability of a disease to spark an outbreak. This project sought to deepen the understanding of these relationships, which touch upon several different areas of mathematics, and to understand their influence on other aspects of the disease, such as seasonal oscillations.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/research-in-teams/13rit168>

MSI: Music, Film and Mathematics Together August 10-20, 2013

Organizers:

Andrew Granville (Université de Montréal)

Jenny Granville (Leeds Metropolitan University)

In 2009, siblings Jennifer and Andrew Granville completed the screenplay, Mathematical Sciences Investigation (MSI): The anatomy of integers and permutations, based on analogies between the genetic similarities of twins, the surprisingly similar mathematical structure of the prime factors of typical integers, and of the cycles of typical permutations. The objective in writing this screenplay was to reach a wider-than-usual audience for mathematical exposition. Throughout, Tommy Britt, a documentary filmmaker, had been recording elements of the project -- creative meetings, rehearsals, interviews and performances -- focusing on the creative and mathematical challenges that had emerged through these unique collaborations. This project at BIRS enabled the artists and mathematicians to complete post-production on this documentary, exploring further how to present complex mathematical concepts in different forms.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/research-in-teams/13rit192>

Participants:

Britt, Thomas (George Mason University)

Granville, Andrew (Université de Montréal)

Granville, Jenny (Leeds Metropolitan University)

Schneider, Robert (Emory University)

Multiscale Analysis of Stochastic Spatial Chemical Reaction Networks September 1-8, 2013

Organizers:

Peter Pfaffelhuber (University of Freiburg)

Lea Popovic (Concordia University)

The goal of this research in teams was to apply and extend recently developed theory for spatial multi-scale chemical reaction networks (Pfaffelhuber and Popovic (2103)). They considered chemical reaction networks whose dynamics are effective on two time-scales. This means that, for some large N , a subset of species changes on time-scale $N\delta t$, while the rest, which are the subset of interest, only change on time-scale δt . In addition, species move between compartments at scale $N\delta t$ for some $a > 0$. For the overall dynamics of species of interest, the value $a=1$ is a phase transition. If $a < 1$ the chemical reactions within each compartment dominate because the movement is too slow to counteract them. The opposite is true if $a > 1$, where species are uniformly (according to some equilibrium distribution for the movement) distributed over all compartments, and they are involved in chemical reactions in their average amounts.

The following objectives were worked on: 1) Spatial Michaelis-Menten kinetics and co-localization of molecules; 2) Fine analysis of interactions of fast reactions and movement; 3) Large spatial systems and the role of dimension.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/research-in-teams/13rit182>

Mathematical Methods for Bar Code Decoding

October 20-27, 2013

Organizers:

Fadil Santosa (University of Minnesota)

Rachel Ward (University of Texas)

The research team planned to investigate the problem of bar code decoding in difficult environment. The goal was to develop practical robust algorithms for hand-held camera-based scanners that could read bar codes from a large distance in poor lighting conditions. The mathematical problems to be overcome included pattern recognition and image super-resolution.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/research-in-teams/13rit185>

Participants:

Iwen, Mark (Michigan State University)
Madej, Dariusz (Motorola Solutions)

Santosa, Fadil (University of Minnesota)
Ward, Rachel (University of Texas)

Smooth Relaxations of Large-Scale Optimization Problems, with Applications to Sparse Optimization and Semidefinite Programming

October 27-November 3, 2013

Organizers:

Aleksandr Aravkin (IBM T. J. Watson Research Center)
James Burke (University of Washington)

Michael Friedlander (University of British Columbia)
Nathan Krislock (Northern Illinois University)

The large-scale nature of modern applications is an exciting challenge for modern optimization algorithms. Many important large-scale applications require sparse and semidefinite optimization, including image reconstruction, protein structure determination, and wireless sensor localization. This project used known techniques from convex analysis (Moreau-Yosida smoothing and projection onto convex cones) in a new way to develop the next generation of fast matrix-free methods. Because this technology was mainly one of reformulation, the resulting methods could be applied to a vast range of applications through generally available solvers.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/research-in-teams/13rit183>

Focussed Research Groups

Effective Computations in Arithmetic Mirror Symmetry March 17 – 24, 2013

Organizers:

Charles Doran (University of Alberta)
Adriana Salerno (Bates College)

Ursula Whitcher (University of Wisconsin-Eau Claire)



In string theory, Calabi-Yau varieties describe the extra dimensions of the universe, beyond the three spatial and one time dimension that we move through every day. Mirror symmetry is a mathematical interpretation of a conjecture first formulated by physicists, which states that Calabi-Yau varieties should occur in pairs. The main objective of this focussed research group was to study the number-theoretic implications of mirror symmetry. More explicitly, how mirror symmetry was reflected in the structure of the congruent zeta function for mirror pairs. Although tantalizing, the arithmetic implications of mirror symmetry has only been explored in a few special cases, due to the computational challenges of studying the number-theoretic properties of higher-dimensional varieties. New advances in computational number theory offered a framework for computing and understanding the congruent zeta function. We investigated experimentally the arithmetic mirror symmetry for a broad class of hypersurfaces, including non-diagonal hypersurfaces in projective space and specific families of hypersurfaces in toric varieties. This approach provided a powerful tool for making predictions about the arithmetic properties of general Calabi-Yau varieties and offered a means to investigate the properties of the zeta function for singular hypersurfaces. This research group brought together the expertise of an internationally recognized group of algebraic geometers, mathematical physicists and computational number theorists.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/focussed-research-groups/13frg165>

Participants:

de la Ossa, Xenia (University of Oxford)
Doran, Charles (University of Alberta)
Harder, Andrew (University of Alberta)
Kelly, Tyler (University of Pennsylvania)

Malmendier, Andreas (Colby College)
Salerno, Adriana (Bates College)
Sperber, Steven (University of Minnesota)
Whitcher, Ursula (University of Wisconsin-Eau Claire)

Network Models of Financial Systemic Risk

May 5-12, 2013

Organizers:

Tom Hurd (McMaster University)

Alfred Lehar (University of Calgary)



The study of cascading failures in interbank networks has been active in the economics community for a number of years. However, it is only since the financial crisis of 2007-08 that this question of paramount importance to society has been addressed by analogy with information cascades and epidemics in social networks. The one-week focussed research group project developed deliberately simplified models of cascading insolvency and illiquidity in financial networks that had potential to have significant impact on the foundations of a rapidly developing field of applied science.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/focussed-research-groups/13frg184>

Participants:

Cellai, Davide (University of Limerick)
Cheng, Huibin (McMaster University)
Ebrahimi Kahou, Mahdi (University of Calgary)
Grasselli, Matheus (Fields Institute)

Hurd, Tom (McMaster University)
Lehar, Alfred (University of Calgary)
Melnik, Sergey (University of Limerick)
Shao, Quentin (McMaster University)

Cerebral Blood Flow, Neurovascular Coupling, and Cortical Spreading Depression

June 9-16, 2013

Organizers:

Huaxiong Huang (York University)

Robert M. Miura (New Jersey Institute of Technology)

This workshop brought together researchers from the areas of mathematical modeling and biomedical engineering, as well as experimentalists to address some of the fundamental issues related to cerebral blood flow, neurovascular coupling, and cortical spreading depression (CSD). The main objective of the workshop was to discuss and incorporate recent advances in experimental studies into mathematical models, which were based on the fundamental laws of biochemistry and biophysics, that were capable of reproducing observed phenomenon and to make predictions that could be verified by further experimental studies. The modeling project in this workshop on CSD is of clinical importance because CSD has been implicated in migraine with aura. Migraine, a neurological disorder, is characterized by mild to severe headaches, and three times more common in women than in men. Furthermore, approximately a third of those people who have migraine see an associated visual aura that precedes the migraine. This is a world-wide disease, and affects more than 10% of the world's population and includes young and old. Therefore, this workshop was suitable as a Mathematics of Planet Earth 2013 project, and fell under the general area of quantitative studies of the medical arts.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/focussed-research-groups/13frg160>

Participants:

Brennan, K.C. (University of Utah)
Chang, Josh (Mathematical Biosciences Institute)
David, Tim (University of Canterbury)
Gong, Xiaobo (Shanghai Jiaotong University)

Huang, Huaxiong (York University)
Miura, Robert M. (New Jersey Institute of Technology)
Takagi, Shu (The University of Tokyo)
Wylie, Jonathan (City University of Hong Kong)

Minimum Rank, Maximum Nullity, and Zero Forcing of Graphs

June 16-23, 2013

Organizers:

Shaun Fallat (University of Regina)

Michael Young (Iowa State University)

Consider a symmetric matrix in which each entry is independently determined to be zero, nonzero, or either. This group deals with determining the minimum rank and maximum nullity over all matrices of this form. In the last five years, we have been able to use graph parameters, specifically zero forcing, to help determine minimum ranks and maximum nullities. In this workshop, we focussed our study on graphs and their complements, as well as subdivided graphs.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/focussed-research-groups/13frg164>

Participants:

Barrett, Wayne (Brigham Young University)
Butler, Steve (Iowa State University)
Catral, Minerva (Xavier University)
Fallat, Shaun (University of Regina)

Hall, Tracy (Brigham Young University)
Hogben, Leslie (Iowa State University)
van den Driessche, Pauline (University of Victoria)
Young, Michael (Iowa State University)

Numerical Methods for Optimal Transportation

July 21-28, 2013

Organizers:

Jean-David Benamou (INRIA)

Adam Oberman (McGill University)

This workshop built on the participants' existing work, to improve the scope and power of an existing solver, and to build new solvers in for more general optimal transportation (OT) problems. This will allow for previously unavailable applications to the areas mentioned above, in particular gradient flows and mathematical economics. The method proposed by Oberman, Froese and Benamou in two recent publications is a significant improvement to existing Monge-Ampère solvers: it computes (possibly singular) OT solutions for very general data. A proof of convergence is given and numerical experiments indicate that the computational cost is log linear in the size of the problem. It creates opportunities for new numerical application of OT.

The meeting brought mathematicians and numerician specialists of Monge-Ampère/optimal transportation, as well as mathematicians working on new economic models. They focussed, in particular, on the numerical resolution of generalized Monge-Ampère/optimal transport equations arising as the Euler-Lagrange equation of a class of variational problems under convexity constraints and attempted to formulate and solve test problems for the principal-agent problem and Cournot-Nash equilibria which enter this class of problems.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/focussed-research-groups/13frg167>

Participants:

Agueh, Martial (University of Victoria)

Benamou, Jean-David (INRIA)

Carlier, Guillaume (Universite Paris Dauphine)

Ekeland, Ivar (Université Paris-Dauphine)

Froese, Brittany (University of Texas at Austin)

Oberman, Adam (McGill University)

Oudet, Edouard (Universite Joseph Fourier)

Pass, Brendan (University of Alberta)

Advancing Deterministic Algorithms for Mixed-Effects Modelling in R

August 11-18, 2013

Organizers:

Steven Walker (McMaster University)

Statistical analysis is simpler when data have been sampled independently. But independent sampling is often impractical or impossible in real-world studies. Consider, for example, a study on the health of urban Canadians. Two individuals sampled from the same city would be more likely to share symptoms than individuals sampled from different cities. Such a study would lead to statistical dependence among individuals from the same city, which may systematically bias conclusions. However, it is possible to conduct statistical analyses with the potential to correct for such biases -- a technique called mixed effects modelling. This technique poses many technical and conceptual challenges that do not arise in the analysis of independent samples. For example, mixed effects modelling requires relatively more computer time than techniques designed for independent samples, potentially inhibiting the use of these techniques on large data sets. Further, for certain statistical problems, software for mixed effects modelling may not even exist or may be prohibitively expensive. The central goal of this focused research group was to expand the range and quality of free and open-source computational tools available for analyzing data with mixed models.

For details, please refer to the workshop webpage
<http://www.birs.ca/events/2013/focussed-research-groups/13frg180>

Participants:

Bates, Douglas (University of Wisconsin Madison)

Bolker, Benjamin (McMaster University)

Christensen, Rune Haubo B (Technical University of Denmark)

Dorie, Vincent (Columbia University)

Højsgaard, Søren (Aalborg University)

Maechler, Martin (ETH Zurich)

Scheipl, Fabian (Ludwig Maximilians Universität)

Walker, Steven (McMaster University)



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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