BIRS-CMO 2019 Annual Report

Banff International Research Station
for Mathematical Innovation and Discovery

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BIRS 2019 Program

5-Day Workshops 2019

Jan 13	Jan 18	Models and Algorithms for Sequential Decision Problems Under Uncertainty
Jan 20	Jan 25	Representation Theory Connections to (q,t)-Combinatorics
Jan 27	Feb 1	Optimal Transport Methods in Density Functional Theory
Feb 3	Feb 8	The Role of Genomics and Metagenomics in Human Health
Feb 10	Feb 15	Computational Light Transport
Feb 17	Feb 22	Statistical Analysis of Large Administrative Health Databases
Feb 24	Mar 1	Frontiers in Single-cell Technology, Applications and Data Analysis
Mar 3	Mar 8	Phase-Field Models of Fracture
Mar 10	Mar 15	Asymptotic Algebraic Combinatorics
Mar 17	Mar 22	Mathematical Criminology and Security
Mar 24	Mar 29	The Topology of Nucleic Acids: Research at the Interface of Low-Dimensional Topology, Polymer Physics and Molecular Biology
Mar 31	Apr 5	Multivariable Spectral Theory and Representation Theory
Apr 7	Apr 12	New and Evolving Roles of Shrinkage in Large-Scale Prediction and Inference
Apr 14	Apr 19	Probing the Earth and the Universe with Microlocal Analysis
Apr 21	Apr 26	Quantum Walks and Information Tasks
Apr 28	May 3	Modelling of Thin Liquid Films-Asymptotic Approach vs. Gradient Dynamics
May 5	May 10	Nonlinear Geometric PDE's
May 12	May 17	Women In Numerical Methods for PDEs and their Applications
May 19	May 24	Optimal Neuroethology of Movement and Motor Control
May 26	May 31	Geometry of Real Polynomials, Convexity and Optimization
Jun 2	Jun 7	Toward a Comprehensive, Integrated Framework for Advanced Statistical Analyses of Observational Studies
Jun 9	Jun 14	Women In Analysis
Jun 16	Jun 21	Bridging Cellular and Tissue Dynamics from Normal Development to Cancer: Mathematical, Computational, and Experimental Approaches
Jun 23	Jun 28	Reconstruction Methods for Inverse Problems
Jun 30	Jul 5	Advances in Dispersive Equations: Challenges & Perspectives
Jul 7	Jul 12	Algebraic Techniques in Computational Complexity
Jul 14	Jul 19	The Many Faceted Connes Embedding Problem
Jul 21	Jul 26	Algebraic and Statistical ways into Quantum Resource Theories
Jul 28	Aug 2	New Mathematical Methods for Complex Systems in Ecology
Aug 4	Aug 9	From Many Body Problems to Random Matrices
Aug 11	Aug 16	Convex Integration in PDEs, Geometry, and Variational Calculus
Aug 11	Aug 16	Mutations: Mirror Symmetry, Deformations, and Combinatorics
Aug 18	Aug 23	Charge and Energy Transfer Processes: Open Problems in Open Quantum Systems
Aug 25	Aug 30	Groups and Geometries
Sep 1	Sep 6	Workshop on Probabilistic and Extremal Combinatorics
Sep 8	Sep 13	Topology and Measure in Dynamics and Operator Algebras
Sep 15	Sep 20	Random Matrix Products and Anderson Localization
Sep 15	Sep 20	Emerging Statistical Challenges & Methods for Analysis of Human Microbiome Data
Sep 22	Sep 27	New Challenges in Energy Markets - Data Analytics, Modelling and Numerics
Sep 29	Oct 4	Classification Problems in von Neumann Algebras
Oct 6	Oct 11	Herglotz-Nevanlinna Theory Applied to Passive, Causal and Active Systems
Oct 13	Oct 18	Physics-Dynamics Coupling in Earth System Models
Oct 13	Oct 18	Spaces of Embeddings: Connections and Applications
Oct 20	Oct 25	Women in Commutative Algebra
Oct 27	Nov 1	Bridging the Gap between Kahler and non-Kahler Complex Geometry
Nov 3	Nov 8	Unifying 4-Dimensional Knot Theory
Nov 10	Nov 15	Interactions between Brauer Groups, Derived Categories and Birational Geometry of Projective Varieties
Nov 17	Nov 22	Dimers, Ising Model, and their Interactions
Nov 24	Nov 29	Theoretical Foundations of Relativistic Hydrodynamics
Dec 1	Dec 6	Challenges in Mathematical and Computational Modeling of Complex Systems
Dec 8	Dec 13	Discrete Subgroups of Lie Groups

2-Day Workshops 2019

Feb 8	Feb 10	First Year Mathematics Repository Workshop
Apr 5	Apr 7	Precise computation of quantum amplitudes
Apr 12	Apr 14	Tissue Constitutive Models in Human Body Models for Enhanced Safety
Apr 26	Apr 28	Ted Lewis SNAP Math Fair Workshop
May 10	May 12	Alberta Number Theory Days XI (ANTD XI)
Jun 21	Jun 23	Innovations in New Instructor Training
Jul 26	Jul 28	Open Education Resources and Technologies in Mathematics
Aug 9	Aug 11	Mathematics and Computer Science in Modeling and Understanding of Structure and Dynamics of Biomolecules
Sep 13	Sep 15	Canadian Workshop on Linked Open Data for Cultural Scholarship
Sep 27	Sep 29	Retreat for Young Researchers in Probability and areas of Application

Focused Research Groups

Feb 17	Feb 24	Quantum Field Theory and Factorization Algebras
Mar 31	Apr 7	Towards Spacetime Entanglement Entropy for Interacting Theories
Apr 28	Apr 5	Learning and Animal Movement
May 12	May 19	Mathematical Theories of the Madden-Julian Oscillation
May 19	May 26	Concentration, Relaxation and Mixing time for Restricted Lattices
Jun 9	Jun 16	Permutation Polynomials over Finite Fields
Jun 23	Jun 30	Extremal Blaschke Products
Jul 14	Jul 21	Novel Mathematical & Statistical Approaches to predicting Species' Movement under Climate Change
Jul 21	Jul 28	The Voganish Project

Research in Teams

Jan 20	Jan 27	An Optimal Transport Approach to Crop Root Systems and related Multiscale Structures
Apr 14	Apr 21	Analysis and Geometry of Several Complex Variables
Jun 2	Jun 9	Stability of Multidimensional Waves
Jun 16	Jun 23	p-adic Dynamics of Hecke Operators
Jun 30	Jul 7	Counting *V*-Tangencies and Nodal Domains
Jul 7	Jul 14	Serre Weight Conjectures for *p*-adic Unitary Groups
Sep 29	Oct 6	Dispersion Interactions via Optimal Transport
Oct 27	Nov 3	Signal Processing on Graphs

Banff International Research Station

2019

5-Day Workshops

Models and Algorithms for Sequential Decision Problems Under Uncertainty
January 13 - 18, 2019

Organizers:

Vineet Goyal (Columbia University)
Chaithanya Bandi (Northwestern University)
Daniel Kuhn (Ecole Polytechnique Federale de Laussane)

In most real world problems including engineering system design, risk management in financial and other domains, pricing and revenue management and many other applications, critical decisions are often made sequentially and in the face of uncertainties. These uncertainties arise from several factors including statistical errors in parameters estimation, uncertainty in measurement, uncertainty in future exogenous variables and uncertainty in model correctness itself. Therefore, sequential decision problems under uncertainty are an important class of problems both from a theoretical as well as practical point of view, relevant to many areas of applied science, including statistical estimation and inference, and control theory, and have been extensively studied in the literature.This workshop brought together leading researchers both senior and young from different fields including Operations Research, Statistics, and Computer Science to focus on these different paradigms for sequential decision problems under uncertainty. The workshop provided an overview of the state-of-the-art in these different fields; with a goal to stimulate discussions and exchange of ideas between researchers from these different fields that typically would not get a chance to interact and collaborate. The focus will be to explore relationships between these different approaches, more specifically, between robust optimization and online optimization.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5231

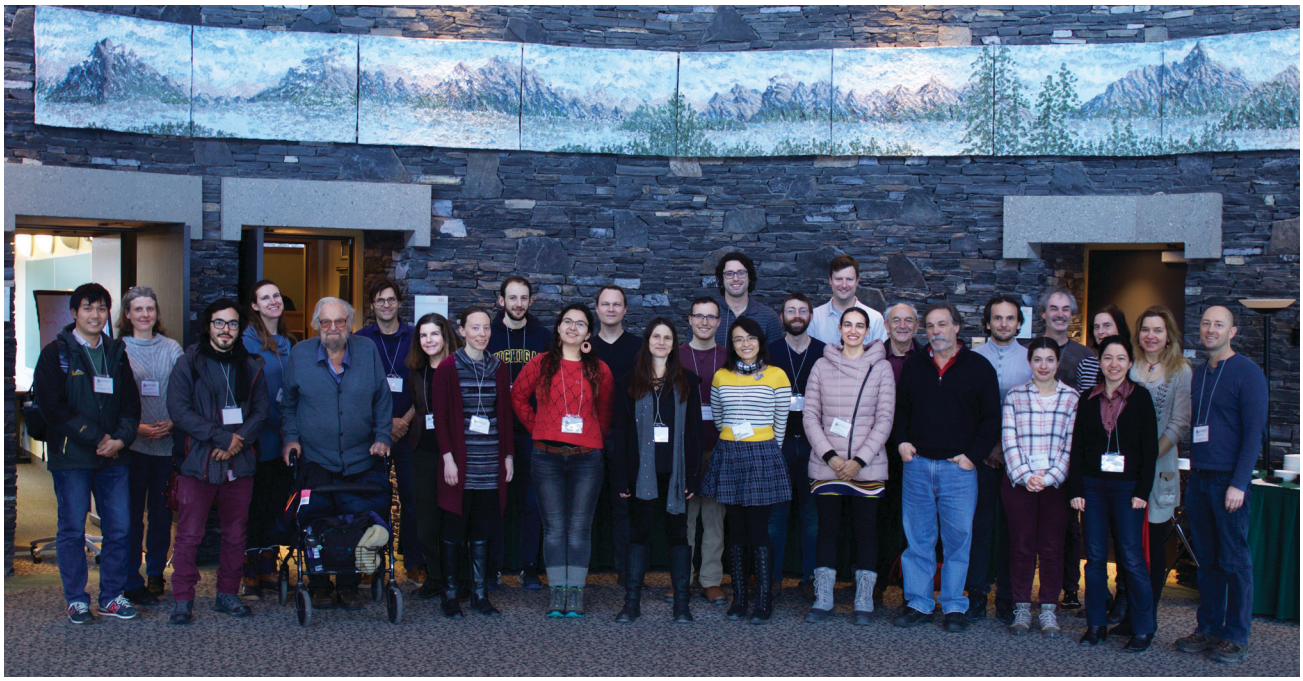
Participants:

Agrawal, Shipra (Columbia University)
Bandi, Chaithanya (Northwestern University)
Bayraksan, Guzin (Ohio State University)
Campi, Marco (University of Brescia)
Delage, Erick (HEC Montréal)
El Housni, Omar (Columbia University)
Garatti, Simone (Politecnico di Milano)
Goyal, Vineet (Columbia University)
Grand Clement, Julien (Columbia University)
Gupta, Varun (University of Chicago)
Gupta, Vishal (University of Southern California)
Kallus, Nathan (Cornell University)
Kilinc-Karzan, Fatma (Carnegie Mellon University)
Kuhn, Daniel (EPFL)
Lim, Andrew (National University of Singapore)
Long, Daniel Zhuoyu (Chinese University of Hong Kong)
Manshadi, Vahideh (Yale University)
Mohajerin Esfahani, Peyman (Delft University of Technology)
Natarajan, Karthik (Singapore University of Technology and Design)
Nguyen, Viet-Anh (EPFL)
Nohadani, Omid (Northwestern University)
Shmoys, David (Cornell University)
Shtern, Shimrit (Technion)
Singh, Mohit (Georgia Institute of Technology)
Sturt, Brad (MIT)
Udwani, Rajan (Columbia University)
Vayanos, Phebe (University of Southern California)
Wei, Yehua (Boston College)
Wiesemann, Wolfram (Imperial College London)
Xu, Huan (Georgia Institute of Technology)

Representation Theory Connections to (q,t)-Combinatorics
January 20 - 25, 2019

Organizers:

Mike Zabrocki (York University)
François Bergeron (Université du Québec à Montréal)
Jim Haglund (University of Pennsylvania)



It is well recognized that one of the most important topics in modern mathematics and mathematical physics is representation theory. Recent advances linking Macdonald polynomials (an object of central importance to algebraic combinatorics which depends on two parameters q,t) to geometry and integrable models of mathematical physics have resulted in a number of amazing new formulas potentially describing the refined decomposition into “irreducible” pieces of central representations for these two fields. However the formulas that we currently have are only expressed in terms of monomials, rather than “Schur functions”,which would be much preferable. This workshop brought together a diverse set of top researchers from algebraic combinatorics, knot theory, and algebra, with the aim of exploiting these recent advances in order to find the required explicit Schur expressions, and obtain new combinatorial expressions regarding the associated knot invariants.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5131

Participants:

Assaf, Sami (University of Southern California)
Bergeron, François (Université du Québec à Montréal)
Bergeron, Nantel (York University)
Delcroix-Oger, Bérénice (Université Paris Diderot)
Fishel, Susanna (Arizona State University)
Frieden, Gabriel (Université du Québec à Montréal)
Garsia, Adriano (UC San Diego)
Gonzalez, Nicolle (UCLA)
Haglund, Jim (University of Pennsylvania)
Hicks, Angela (Lehigh University)
Hogancamp, Matthew (Northeastern University)
Lapointe, Luc (Universidad de Talca)
Mason, Sarah (Wake Forest University)
Mazin, Mikhail (Kansas State University)
Morse, Jennifer (University of Virginia)
Morton, Hugh (University of Liverpool)
Paget, Rowena (University of Kent)
Panova, Greta (University of Pennsylvania and IAS Princeton)
Pawlowski, Brendan (University of Southern California)
Pun, Ying Anna (Drexel University)
Qiu, Dun (UC San Diego)
Rhoades, Brendon (UC San Diego)
Romero, Marino (UC San Diego)
Samuelson, Peter (University of Edinburgh)
Schilling, Anne (University of California - Davis)
Warrington, Greg (University of Vermont)
Williams, Nathan (University of Texas at Dallas)
Williams, Lauren (U.C. Berkeley)
Zabrocki, Mike (York University)

Optimal Transport Methods in Density Functional Theory
January 27 - February 1, 2019

Organizers:

Mathieu Lewin (CNRS & Université Paris Dauphine)
Paola Giorgi (Vrije Universiteit Amsterdam)
Brendan Pass (University of Alberta)

Quantum mechanics is a very impressive theory, developed in the beginning of the XX century to describe the microscopic world. Unfortunately, the numerical cost involved to compute approximate solutions of Schrödinger's equation grows extremely fast with the number of particles in the system. Density functional theory, by virtue of its computational efficiency, is the method of choice for the electronic structure calculations. Despite its enormous success, its predictive power is still hampered by inadequate approximations, for instance when dealing with technologically advanced materials and man-made nanostructures.

The purpose of the workshop was to gather mathematicians, chemists and physicists working on the use of optimal transport methods in density functional theory. Optimal transport is a theory which allows to find, for instance, the most efficient way of transporting pastries from bakeries to cafés. It has recently been discovered that this theory also plays an important role in density functional theory. The workshop aimed at addressing the full complexity of this new technique, using an interdisciplinary approach.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5035

Participants:

Bindini, Ugo (Scuola Normale Superiore)
Burke, Kieron (University of California, Irvine)
Cances, Eric (Ecole des Ponts and INRIA)
Cazalis, Jean (University Paris-Dauphine)
Champion, Thierry (Université de Toulon)
Cotar, Codina (University College London)
Coyaud, Rafael (Ponts Paris-Tech)
De Pascale, Luigi (University of Firenze)
Di Marino, Simone (Scuola Normale Superiore)
Ernzerhof, Matthias (University of Montreal)
Friesecke, Gero (Technische Universitat Munich)
Garrigue, Louis (Université Paris Dauphine)
Gerolin, Augusto (University of Jyväskylä)
Giarrusso, Sara (VU Universiteit Amsterdam)
Giorgi, Paola (Vrije Universiteit Amsterdam)
Gontier, David (Paris-Dauphine)
Grossi, Juri (VU Universiteit Amsterdam)
Kooi, Derk (VU University of Amsterdam)
Laestadius, Andre (University of Oslo)
Lahbabi, Salma (ENSEM - Université Hassan II de Casablanca)
Lampart, Jonas (CNRS & Université de Bourgogne)
Levitt, Antoine (Inria)
Lewin, Mathieu (CNRS & Université Paris Dauphine)
Lin, Lin (University of California - Berkeley)
Lindsey, Michael (University of California - Berkeley)
Lu, Jianfeng (Duke University)
Maitra, Neepa (City University of New York)
Musslimani, Ziad (Florida State University)
Nenna, Luca (Université Paris Sud)
Ostergaard Sorensen, Thomas (Ludwig-Maximilians-Universität München)
Pass, Brendan (University of Alberta)
Petrache, Mircea (PUC Santiago de Chile)
Pribram-Jones, Aurora (University of California - Merced)
Rota Nodari, Simona (Univ. Bourgogne)
Sabin, Julien (Universite Paris-Sud)
Seidl, Michael (VU Amsterdam)
Vargas-Jimenez, Adolfo (University of Alberta)
Voegler, Daniela (TU Munich)
Ying, Lexing (Stanford University)

The Role of Genomics and Metagenomics in Human Health: Recent Developments in Statistical and Computational Methods
February 3 - 8, 2019

Organizers:

Iuliana Ionita-Laza (Columbia University)
Hongzhe Lee (University of Pennsylvania)
Lluis Quintana-Murci (Pasteur Institute)
Lei Sun (University of Toronto)

Some of the central problems in human genetics and evolutionary biology are (1) understanding the precise biological mechanisms underlying complex disease risk (such as autism, schizophrenia, cancer, infectious and inflammatory diseases, etc.), and (2) how disease has affected the evolutionary history of modern humans. Despite recent progress, the genetic basis remains poorly understood for most diseases. We proposed to focus our workshop on statistical methods aimed at pinpointing the role that genomics and metagenomics play in human health, and how integration of various types of omics data, such as genome, epigenome, transcriptome, proteome, metabolome, metagenome, phenome can lead to a deeper understanding of causes for disease, and new biomarkers for human health and disease. The topics proposed here are at the frontier of human genetics, and a focused workshop provided the ideal platform for discussion of these important areas.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5128

Participants:

Allen, Andrew (Duke University)
Aschard, Hugues (Pasteur Institute)
Barreiro, Luis (University of Chicago)
Bonneau, Richard (New York University and Flatiron Institute (Simons Foundation))
Bull, Shelley (University of Toronto)
Chaterjee, Nilanjan (Johns Hopkins University)
Epstein, Michael (Emory University)
Fukuyama, Julia (Indiana University)
Greenwood, Celia (Lady Davis Institute for Medical Research)
He, Xin (University of Chicago)
Hernandez, Ryan (McGill University)
Hoffman, Michael (University of Toronto)
Huerta-Sanchez, Emilia (Brown University)
Im, Hae Kyung (University of Chicago)
Ionita-Laza, Iuliana (Columbia University)
Jing, Ma (Fred Hutchinson Cancer Institute)
Khurana, Ekta (Weill Cornell Medicine)
Lee, Hongzhe (University of Pennsylvania)
Li, Zhigang (University of Florida)
Li, Huilin (New York University)
Li, Mingyao (University of Pennsylvania)
Lin, Xihong (Harvard University)
Liu, Lei (Washington University Saint Louis)
Lohmueller, Kirk (University of California - Los Angeles)
Mathieson, Iain (University of Pennsylvania)
Mueller, Christian (Simons Foundation)
Pe'er, Itsik (Columbia University)
Quintana-Murci, Lluis (Pasteur Institute)
Roeder, Kathryn (Carnegie Mellon University)
Scott, Laura (University of Michigan)
Shi, Jianxin (National Cancer Institute)
Sohn, Michael (University of Rochester)
Strug, Lisa (Hospital for Sick Children, Toronto)
Sun, Lei (University of Toronto)
Tang, ZhengZheng (University of Wisconsin - Madison)
Wallace, Kristin (Medical Uni. of South Carolina)
Wei, Ying (Columbia University)
Wen, Xiaoquan (University of Michigan)
Zhou, Xiang (University of Michigan)
Zou, James (Stanford University)

Computational Light Transport
February 10 - 15, 2019

Organizers:

Gordon Wetzstein (Stanford University)
Kyros Kutulakos (University of Toronto)
Todd Zickler (Harvard University)

Accelerating advances in electrical, optical, and mechanical materials and devices, combined with the sudden ubiquity of high-performance and large-scale parallel architectures for computing, is revolutionizing our ability to manipulate, measure, and analyze radiation at optical wavelengths. This has created unprecedented opportunity for discovering new forms of imagers, visual displays, and visual sensors, that could have transformative impacts on medicine, robotics, atmospheric science, and more.

This workshop brought together experts from a variety of backgrounds---including optics, computer graphics, and computer vision---to help solidify the mathematical and scientific foundations of a young new field of interdisciplinary study called Computational Light Transport, which is the study of using emitters, detectors, and computation to reveal and analyze the flow of light.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5069

Participants:

Abrahamsson, Sara (UC Santa Cruz)
Bouman, Katie (Caltech / Harvard CFA)
Charbon, Edoardo (EPFL)
Christensen, Marc (Southern Methodist University)
Davis, James (UCSC)
Deon, Eugene (Weta Digital)
Fleischer, Jason (Princeton University)
Freeman, William (Massachusetts Institute of Technology)
Genov, Roman (University of Toronto)
Gkioulekas, Ioannis (Carnegie Mellon University)
Goyal, Vivek (3dim)
Gupta, Mohit (University of Wisconsin-Madison)
Heide, Felix (Princeton University)
Heidrich, Wolfgang (Visual Computing Center at KAUST)
Horstmeyer, Roarke (Duke University)
Kadambi, Achuta (UCLA)
Katz, Ori (Hebrew University)
Koppal, Sanjeev (University of Florida)
Kutulakos, Kyros (University of Toronto)
Levin, Anat (Technion University)
Narasimhan, Srinivasa (Carnegie Mellon University)
Ng, Ren (UC Berkeley)
O'Toole, Matthew (Stanford University)
Poon, Joyce (University of Toronto)
Raskar, Ramesh (MIT Media Lab)
Swedish, Tristan (MIT)
Treibitz, Tali (University of Haifa)
Velten, Andreas (University of Wisconsin - Madison)
Waller, Laura (UC Berkeley)
Wetzstein, Gordon (Stanford University)
Yang, Changhuei (California Institute of Technology)
Zickler, Todd (Harvard University)

Statistical Analysis of Large Administrative Health Databases
February 17 - 22, 2019

Organizers:

Robert Platt (McGill University)
Joan Hu (Simon Fraser University)
Sherri Rose (Harvard University)
Grace Yi (University of Western Ontario)

Administrative systems are used to routinely collect information on health. These systems can be exploited for research purposes, to provide answers to important questions about safety and effectiveness of medications, health services utilization and effectiveness, and costs and benefits of health systems. Statistical tools to work with these administrative systems, often involving machine learning tools, are rapidly being developed; however, much progress is still required.

Administrative data are collected for administrative, not research purposes. As such, the type and quality of information used needs to be accounted for. Incomplete data and measurement error pose particular problems. This workshop assessed the state of the art for administrative data analysis, identified areas where new research is needed, and initiated collaborations on these topics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5027

Participants:

Adhikari, Samrachana (NYU School of Medicine)
Bansal, Aasthaa (University of Washington)
Chen, Li-Pang (University of Waterloo)
Coulombe, Janie (McGill)
Degtiar, Irina (Harvard University)
Fang, Junan (U Waterloo)
Fine, Jason (U North Carolina)
Grandi, Sonia (McGill University)
He, Wenqing (University of Western Ontario)
Hu, Joan (Simon Fraser University)
Jiang, Bei (University of Alberta)
Jiao, Tianze (McGill)
Jin, Zhezhen (Columbia University)
Karim, Mohammad Ehsanul (UBC)
Lian, Yi (McGill University)
Lu, Wenbin (North Carolina State University)
Luo, Kexin (University of Western Ontario)
Ma, Rui (SFU)
Marino, Miguel (Oregon Health & Science University)
McCandless, Lawrence (Simon Fraser University)
Nathoo, Farouk (University of Victoria)
Nelson, Jennifer (Kaiser Permanente)
Pang, Menglan (McGill)
Platt, Robert (McGill University)
Qian, Lianfen (Florida Atlantic University)
Rosychuk, Rhonda (University of Alberta)
Schnitzer, Mireille (Université de Montréal)
Spiegelman, Donna (Harvard School of Public Health)
Stephens-Shields, Alisa (University of Pennsylvania)
Wang, Rui (Harvard)
Wen, Emma (Simon Fraser University)
Wolfson, Julian (University of Minnesota)
Wu, Lang (The University of British Columbia)
Xie, Hui (Simon Fraser University)
Yi, Grace (University of Western Ontario)
Zhang, Ying (Indiana University)
Zhang, Qihuang (University of Waterloo)
Zhuang, Haoxin (Waterloo)

Frontiers in Single-cell Technology, Applications and Data Analysis
February 24 - March 1, 2019

Organizers:

Quan Long (University of Calgary)
Jie Peng (University of California, Davis)
Pei Wang (Icahn School of Medicine at Mount Sinai)

In recent years, single-cell technologies have been widely used to answer scientific questions in system biology, which allows the development of new therapeutic methods tailored to individual patients and holds high promise to lead to more effective diagnostic tests and treatments of cancer. After a period of prolific growth in analysis tools for single-cell data analysis, primarily motivated by diverse applications, the time has come to consolidate the recent progresses and provide a platform where researchers from different disciplines could exchange ideas and start collaboration to push this field forward. This workshop is intended to bring together the leaders in this field, representatives of biotechnological, statistical and computational expertise, and promising young researchers, to charter the path for future development in the field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5032

Participants:

Chen, Mengjie (University of Chicago)
Chowdhury, Shrabanti (Icahn School of Medicine at Mount Sinai)
Gordon, Paul (University of Calgary)
Ji, Hongkai (John Hopkins University Bloomberg School of Public Health)
Li, Jingyi Jessica (UCLA)
Liu, Yunlong (Indiana University School of Medicine)
Long, Quan (University of Calgary)
Peng, Jie (University of California, Davis)
Petralia, Francesca (Icahn School of Medicine at Mount Sinai)
Quon, Gerald (University of California, Davis)
Seaton, Daniel (European Bioinformatics Institute)
Stratton, Jo (Hotchkiss Brain Institute)
Tang, Hua (Stanford University)
Wang, Pei (Icahn School of Medicine at Mount Sinai)
Wang, Edwin (University of Calgary)
Wu, Zhijin (Brown University)
Zhang, Nancy (University of Pennsylvania)
Zhang, Qingrun (University of Calgary)
Zhou, Xiang (University of Michigan)

Isogeometric Splines: Theory and Applications
February 24 - March 1, 2019

Organizers:

John Evans (University of Colorado Boulder)
Bert Juettler (Johannes Kepler University, Linz)
Giancarlo Sangalli (University of Pavia)

Isogeometric Analysis (IGA), introduced in 2005 by the research group of Thomas J.R. Hughes, has emerged as a transformative simulation-based engineering technology. IGA bridges the gap between design (geometric modeling) and analysis (numerical simulation) by employing a unified representation for the geometry of engineering objects. Consequently, IGA harbors the potential to enable widespread use of design space exploration and optimization in engineering practice.

Despite the great promise of IGA, its full potential has been unrealized due to a fundamental difficulty. Namely, state-of-the-art techniques in geometric modeling are generally unable to be directly employed in analysis. The long-term vision of this workshop is to develop a unified geometric modeling framework, referred to as isogeometric splines, that satisfies both the needs of design and analysis a priori. With this vision in mind, the workshop brought together researchers from a wide variety of fields, including computational geometry, approximation theory, numerical analysis, and algebra, to evaluate state-of-the-art geometric modeling approaches and identify promising new directions toward realizing a unified geometric modeling framework.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5196

Participants:

Evans, John (University of Colorado Boulder)
Hiemstra, Rene (The University of Texas at Austin)
Juettler, Bert (Johannes Kepler University, Linz)
Kapl, Mario (Johann Radon Institute for Computational and Applied Mathematics)
Korobenko, Artem (University of Calgary)
Kunoth, Angela (University of Cologne)
Manni, Carla (Università degli Studi di Roma “Tor Vergata”)
Mantzaflaris, Angelos (Inria Sophia Antipolis Méditerranée)
Möller, Matthias (Delft University of Technology)
Mourrain, Bernard (INRIA Sophia-Antipolis)
Peters, Jorg (University of Florida)
Sampoli, Maria Lucia (Università degli Studi di Siena)
Sorokina, Taytana (Towson University)
Speleers, Hendrik (Università degli Studi di Roma “Tor Vergata”)
Takacs, Thomas (Johannes Kepler Universität Linz)
Tani, Mattia (IMATI-CNR, Pavia)
Thomas, Derek (Coreform)
Toshniwal, Deepesh (The University of Texas - Austin)
Vazquez, Rafael (École Polytechnique Fédérale de Lausanne)
Villamizar, Nelly (Swansea University)
Zhang, Jessica (Carnegie Mellon University)

Phase-Field Models of Fracture
March 3 - 8, 2019

Organizers:

Blaise Bourdin (Louisiana State University)
Laura De Lorenzis (Technische Universität Braunschweig)
Masato Kimura (Kanazawa University)

Phase-field models of fracture were originally devised in the mathematics community as numerical approximation of the variational theories of brittle fracture, based on revisiting Griffith's theory from the 1920's with modern mathematical tools.

This workshop brought together a broad multi-disciplinary group from academia and the industry at various stage of their career. The objectives of the workshop were manifold: It sought to restore proper communication between the communities involved by informing each other of the key success and challenges. It tackled a new class of inverse problems arising from optimal design of materials and structures or materials characterization, for instance. Finally, it allowed candid comparison of recently developed numerical approaches, and elaboration of benchmark problems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5207

Participants:

Akagi, Goro (Tohoku University)
Almi, Stefano (TU München)
Babadjian, Jean-François (Université Paris-Sud)
Bhattacharya, Kaushik (California Inst. of Technology)
Bleyer, Jeremy (Ecole Nationale des Ponts ParisTech)
Bourdin, Blaise (Louisiana State University)
Brach, Stella (California Institute of Technology)
Carrara, Pietro (TU Braunschweig)
Crismale, Vito (Ecole Polytechnique)
Dal Maso, Gianni (SISSA)
De Lorenzis, Laura (Technische Universität Braunschweig)
Esedoglu, Selim (University of Michigan)
Francfort, Gilles (Université Paris Nord)
Gerasimov, Tymofiy (TU Braunschweig)
Iurlano, Flaviana (Université Paris 6)
Kimura, Masato (Kanazawa University)
Kuhn, Charlotte (Technische Universität Kaiserslautern)
Lachaud, Jacques-Olivier (Université Savoie Mont Blanc)
Lancioni, Giovanni (Polytechnic University of Marche)
Larsen, Christopher (Worcester Polytechnic Institute)
Lazzaroni, Giuliano (University of Florence)
Leon Baldelli, Andres (CNRS)
Lopez-Pamies, Oscar (University of Illinois Urbana-Champaign)
Marazzato, Frédéric (École Nationale des Ponts et Chaussées)
Mesgarnejad, Ata (Northeastern University)
Negri, Matteo (University of Pavia)
Nishiura, Yasumasa (Advanced Institute for Materials Research)
Reinoso, Jose (University of Seville)
Takaishi, Takeshi (Musashino University)
Takato, Yoichi (AGC Inc.)
Tanaka, Yoshimi (Yokohama National University)
Vidoli, Stefano (Sapienza Università di Roma)
Voorhees, Peter (Northwestern University)
Yoshioka, Keita (Helmholtz Centre for Environmental Research)

Asymptotic Algebraic Combinatorics
March 10 - 15, 2019

Organizers:

Igor Pak (University of California - Los Angeles)
Alejandro Morales (University of Massachusetts Amherst)
Greta Panova (University of Pennsylvania and IAS Princeton)
Dan Romik (University of California Davis)

Algebraic Combinatorics is an area of mathematics that employs methods of abstract algebra, notably group theory and representation theory, in various combinatorial contexts and, conversely, applies combinatorial techniques to problems in algebra and representation theory. Many of its problems arise from the need of quantitative and explicit understanding of algebraic phenomena. Its quantitative aspects focused on explicit enumerative formulas, and combinatorial interpretations for dimensions, multiplicities, structure constants. The main goal of this workshop was to bring together people from all the relevant areas, which are naturally very disjoint -- Algebraic Combinatorics, Analytic Combinatorics, Probability, Representation Theory, to share results and methods and establish the asymptotic study of objects and quantities in Algebraic Combinatorics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5220

Participants:

Assaf, Sami (University of Southern California)
Banderier, Cyril (Paris 13 University)
Baryshnikov, Yuliy (University of Illinois at Urbana-Champaign)
Billey, Sara (University of Washington)
Colmenarejo, Laura (University of Massachusetts - Amherst)
Corteel, Sylvie (CNRS)
Dauvergne, Duncan (Princeton University)
Dittmer, Sam (UCLA)
Dołęga, Maciej (Polish Academy of Sciences)
Dousse, Jehanne (Universität Zürich)
Féray, Valentin (University of Zurich)
Gorin, Vadim (MIT)
Hopkins, Samuel (University of Minnesota)
Keating, David (UC Berkeley)
Kim, Jang Soo (Sungkyunkwan University)
Krattenthaler, Christian (University of Vienna)
Linusson, Svante (KTH-Royal Institute of Technology Stockholm)
Melczer, Stephen (University of Pennsylvania)
Mkrtchyan, Sevak (University of Rochester)
Morales, Alejandro (Uni. of Massachusetts Amherst)
Okada, Soichi (Nagoya University)
Orellana, Rosa (Dartmouth College)
Pak, Igor (University of California - Los Angeles)
Panova, Greta (University of Pennsylvania & IAS Princeton)
Pemantle, Robin (University of Pennsylvania)
Petrov, Leonid (University of Virginia)
Petrov, Fedor (Steklov Mathematical Institute of Russian Academy of Sciences)
Postnova, Olga (St. Petersburg Department of Steklov Mathematical Institute)
Romik, Dan (University of California Davis)
Schilling, Anne (University of California - Davis)
Sniady, Piotr (Polish Academy of Sciences)
Sulzgruber, Robin (Royal Institute of Technology Stockolm)
Tassy, Martin (Dartmouth College)
Tewari, Vasu (University of Pennsylvania)
Thomas, Hugh (UQAM)
Williams, Nathan (University of Texas-Dallas)
Yong, Alexander (University of Illinois at Urbana-Champaign)

Mathematical Criminology and Security
March 17 - 22, 2019

Organizers:

Martin Short (Georgia Institute of Technology)
Theodore Kolokolnikov (Dalhousie University)
David Lloyd (University of Surrey)

Mathematical criminology and security is an emerging field that combines quantitative and qualitative criminology theories with mathematical analysis and methods to provide new tools for understanding and predicting criminal behavior. These tools may then be employed by law enforcement practitioners to provide evidence-based policing strategies to aid in efficient resource allocation. The workshop aimed to scope out new avenues for collaboration between mathematicians and criminologists/crime scientists to tackle the latest challenges facing society in collaboration with police departments internationally.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5101

Participants:

Brantingham, P. Jeffrey (UCLA)
Brantingham, Patricia (Simon Fraser University)
Brantingham, Paul (Simon Fraser University)
Brunton-Smith, Ian (University of Surrey)
Chiang, Wen-Hao (Indiana University)
D'Orsogna, Maria Rita (Calfiornia State University Northridge)
Davies, Toby (University College London)
Fetecau, Razvan (Simon Fraser University)
Gai, Chunyi (Dalhousie)
Gilmour, Craig (University of Strathclyde)
Kolokolnikov, Theodore (Dalhousie University)
Li, Hao (UCLA)
Lloyd, David (University of Surrey)
McCalla, Scott (Montana State University)
Mohler, George (Indiana University–Purdue University Indianapolis)
Porter, Michael (University of Virginia)
Rodriguez-Bunn, Nancy (University of Colorado Boulder)
Santitissadeekorn, Naratip (University of Surrey)
Short, Martin (Georgia Institute of Technology)
Ward, Jonathan (University of Leeds)
Wilson, Stephen (University of Strathclyde)
Xie, Yao (Georgia Institute of Technology)
Yuan, Baichuan (University of California - Los Angeles)

The Topology of Nucleic Acids: Research at the Interface of Low-Dimensional Topology, Polymer Physics and Molecular Biology
March 24 - 29, 2019

Organizers:

Christine Soteros (University of Saskatchewan)
Javier Arsuaga (University of California, Davis)
Mario Eudave-Muñoz (UNAM)
Koya Shimokawa (Saitama University)

The study of the geometry and topology of nucleic acids provides examples where deep mathematical methods such as those stemming from low-dimensional topology meet high-end experimental data and sophisticated computational techniques. The field of DNA topology has welcomed a diverse and highly interdisciplinary group of scientists, and although much progress has been made, there are still many open questions. This workshop brought together topologists, experimentalists, biologists, biophysicists, physicists and applied mathematicians to work on developing new analytical and computational frameworks to understand the novel experimental data.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5226

Participants:

Arsuaga, Javier (University of California - Davis)
Beaton, Nicholas (University of Melbourne)
Cantarella, Jason (University of Georgia)
Chapman, Harrison (Colorado State University)
Clisby, Nathan (Swinburne University of Technology)
Clysdale, Robin (Scouts Canada)
Deguchi, Tetsuo (Ochanomizu University)
Diao, Yuanan (University of North Carolina)
Eng, Jeremy (University of Saskatchewan)
Ernst, Claus (Western Kentucky University)
Eudave Munoz, Mario (UNAM)
Flapan, Erica (Pomona College)
Frias, Jose Angel (UNAM)
Harris, Sarah (University of Leeds)
Harshey, Rasika (University of Texas at Austin)
Huh, Youngsik (Hanyang University)
Ishihara, Kai (Yamaguchi University)
Janse van Rensburg, Esaias J (York University)
Jayaram, Makkuni (University of Texas at Austin)
Jonoska, Natasha (University of South Florida)
Klingbeil, Michele (University of Massachusetts)
Levene, Stephen (University of Texas at Dallas)
Manjarrez, Fabiola (UNAM)
Medina Graciano, Carolina (Universidad Autónoma de San Luis Potosí Inicio)
Millett, Kenneth (University of California - Santa Barbara)
Moore, Allison (University of California Davis)
Nicodemi, Mario (Universita' di Napoli)
Njagarah, Hatson John Boscoh (Botswana International University of Science and Technology)
Noy, Agnes (University of York)
Olson, Wilma (Rutgers University)
Panagiotou, Eleni (University of California - Santa Barbara)
Pyne, Alice (University College London)
Rechnitzer, Andrew (University of British Columbia)
Sazdanovic, Radmila (North Carolina State University)
Schmirler, Matthew (University of Saskatchewan)
Shimokawa, Koya (Saitama University)
Shoura, Massa (Stanford University)
Soteros, Christine (University of Saskatchewan)
Sumners, De Witt (Florida State University)
Vazquez, Mariel (University of California, Davis)
Walker, David (University of Texas at Austin)
Ziegler, Uta (Western Kentucky University)
Ziraldo, Rick (University of Texas at Dallas)

Multivariable Spectral Theory and Representation Theory
March 31 - April 5, 2019

Organizers:

Raul Curto (University of Iowa)
Zeljko Cuckovic (University of Toledo)
Michael Stessin (University at Albany)

The workshop brought together specialists in functional anaysis, representation theory of groups, and algebraic geometry to study the interplay between multivariable spectral theory, group theory, ad algebraic geometry. The workshop provided a forum for discussion of mathematical topics of substantial interest which have received increased atention in the last few years. The selection of invited speakers and participants took into account the need to allow for fruitful interactions between internationally known experts and junior mathematicians, including women and members of underrepresented groups.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5137

Participants:

Bercovici, Hari (Indiana University)
Bleher, Frauke (University of Iowa)
Clare, Pierre (College of William and Mary)
Clouatre, Raphael (University of Manitoba)
Cuckovic, Zeljko (University of Toledo)
Curto, Raul (University of Iowa)
Davidson, Kenneth R. (University of Waterloo)
Eschmeier, Joerg (Universitat des Saarlandes)
Gandini, Francesca (University of Michigan)
Infusino, Maria (University of Konstanz)
Iyengar, Srikanth (University of Utah)
Kinser, Ryan (University of Iowa)
Klep, Igor (University of Auckland)
Kuhlmann, Salma (Universität Konstanz)
Liaw, Constanze (University of Delaware)
Peebles, Tom (University at Albany)
Popescu, Gelu (UT San Antonio)
Putinar, Mihai (University of California - Santa Barbara)
Quertermous, Katie (James Madison University)
Raissy, Jasmin (Université de Toulouse 3 Paul Sabatier)
Reznikoff, Sarah (Kansas State University)
Sam, Steven (University of California, San Diego)
Schiffler, Ralf (University of Connecticut)
Sottile, Frank (Texas A & M University)
Stessin, Michael (University at Albany, SUNY)
Tchernev, Alex (University at Albany)
Vasilevski, Nikolai (CINVESTAV del IPN)
Vinnikov, Victor (Ben Gurion University of the Negev)
Volcic, Jurij (Texas A&M University)
Yang, Rongwei (SUNY Albany)
Yoo, Seonguk (Gyeongsang National University)
Zhu, Kehe (State University of New York at Albany)

New and Evolving Roles of Shrinkage in Large-Scale Prediction and Inference
April 7 - 12, 2019

Organizers:

Gourab Mukherjee (University of Southern California)
Edward George (University of Pennsylvania)
Eric Marchand (University of Sherbrooke)
Debashis Paul (University of California - Davis)

In recent years, statistical shrinkage methods have been widely used to answer science and policy questions in experiments and instances that involve inferences and predictions based on big-data sets. Our theoretical understanding of the effectiveness of traditional shrinkage algorithms is built on some of the most elegant and seminal works in statistical decisions theory. In this avenue, several new theoretical phenomena and results characterizing the efficacy of shrinkage in modern large-scale applications and big-data regimes have recently been developed. It is an opportune time to consolidate and unify these recent progresses in the dual frontiers of applications and theory to build a robust inferential framework for the disciplined development and analysis of shrinkage methods that take into account the increasing complexities of the data. This workshop provided a platform where researchers could exchange ideas and start collaboration on scientific projects and is intended to bring together the leaders in this field, representatives of application areas, and promising young researchers to charter the path for future development in the field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5188

Participants:

Ahmed, Ejaz (Brock University)
Aue, Alexander (University of California Davis)
Bhattacharya, Anirban (Texas A&M University)
Bhattacharya, Bhaswar (University of Pennsylvania)
Cannings, Timothy (University of Edinburgh)
Choi, Yunjin (National University of Singapore)
Dette, Holger (Ruhr-Universität Bochum)
Erdogdu, Murat (University of Toronto)
Fan, Yingying (University of Southern California)
Gangopadhyay, Ujan (University of Southern California)
George, Edward (University of Pennsylvania)
Ghosh, Malay (University of Florida)
Gu, Jiaying (University of Toronto)
Guntuboyina, Aditya (University of California - Berkeley)
Johnstone, Iain (Stanford University)
Koenker, Roger (University College London)
Komaki, Fumiyasu (The University of Tokyo)
Li, Jialiang (Associate Professor)
Liang, Feng (University of Illinois - Urbana Champaign)
Loftus, Joshua (New York University)
Lopes, Miles (University of California at Davis)
Lv, Jinchi (University of Southern California)
Marchand, Eric (University of Sherbrooke)
Maruyama, Yuzo (University of Tokyo)
Matsuda, Takeru (University of Tokyo)
Mondal, Debashis (Oregon State University)
Mukherjee, Gourab (University of Southern California)
Pati, Debdeep (Texas A&M University)
Paul, Debashis (University of California - Davis)
Purdom, Elizabeth (University of California - Berkeley)
Strawderman, William (Rutgers University)
Volgushev, Stanislav (University of Toronto)
Xu, Xinyi (Ohio State University)
Yano, Keisuke (University of Tokyo)
Zhang, Cun-Hui (Rutgers University)
Zhao, Qingyuan (University of Pennsylvania)

Probing the Earth and the Universe with Microlocal Analysis
April 14 - 19, 2019

Organizers:

Leo Tzou (University of Sydney)

Gunther Uhlmann (University of Washington & HKUST)

We use mathematics to model problems arising in seismic imaging and cosmological tomography. The workshop gathered researchers in who study this problem from different perspectives. This synergy led to progress and discovery of further areas of research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5238

Participants:

Alexakis, Spyros (University of Toronto)
Balehowsky, Tracey (University of Helsinki)
Baskin, Dean (Texas A&M University)
Cekic, Mihajlo (Max Planck Institute - Bonn)
Datchev, Kiril (Purdue University)
de Hoop, Maarten (Rice University)
Dyatlov, Semyon (UC Berkeley)
Eptaminitakis, Nikolaos (University of Washington)
Graham, Robin (University of Washington)
Holman, Sean (University of Manchester)
Ilmavirta, Joonas (University of Jyväskylä)
Kian, Yavar (Université d'Aix-Marseille)
Krupchyk, Katya (UC Irvine)
Lefeuvre, Thibault (Université d'Orsay)
Liu, Boya (University of California - Irvine)
Meyerson, Reed (University of Washington)
Monard, Francois (University of California - Santa Cruz)
Oksanen, Lauri (University College London)
Paternain, Gabriel (University of Cambridge)
Rowlett, Julie (Chalmers University and the University of Gothenburg)
Sa Barreto, Antonio (Purdue University)
Saksala, Teemu (Rice University)
Schlue, Volker (Melbourne University)
Shankar, Ravi (University of Washington)
Stefanov, Plamen (Purdue University)
Tacy, Melissa (University of Otago)
Tarikere, Ashwin (University of Washington)
Tzou, Leo (University of Sydney)
Uhlmann, Gunther (University of Washington & HKUST)
Vasy, András (Stanford University)
Vig, Amir (University of California Irvine)
Yang, Yang (Michigan State University)
Zhou, Hanming (UC Santa Barbara)
Zou, Yuzhou (Stanford University)

Quantum Walks and Information Tasks
April 21 - 26, 2019

Organizers:

Luis Velazquez (Universidad de Zaragoza)
Harry Buhrman (University of Amsterdam)
Manuel D. de la Iglesia (UNAM)
Luc Vinet (Université de Montréal)

Research in quantum mechanics is in a new stage which not only comprises the understanding of quantum laws, but also their use for the development of revolutionary information and communication technologies. Many challenges remain, the most prominent one being the leap from classical to quantum computers. Quantum walks are key tools in this highly topical field. They bring together many areas from physics, mathematics and information science, originating fruitful symbiosis among all of them. Using the notion of quantum walk as a guiding thread, this workshop is envisaged to cover the mathematical aspects behind cutting-edge research in quantum physics and quantum information. These activities aimed to serve as a breeding ground for the communication among researchers from disparate areas, fostering new interdisciplinary collaborations to fuel further advances requiring the join effort of different scientific communities.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5146

Participants:

Ambainis, Andris (University of Latvia)
Asboth, Janos (Wigner Research Centre for Physics Hungary)
Bannink, Tom (Center for Mathematics and Computer Science Amsterdam)
Buhrman, Harry (University of Amsterdam)
Chan, Ada (York University)
Coutinho, Gabriel (Federal University of Minas Gerais)
de la Iglesia, Manuel Domínguez (UNAM)
Feder, David (University of Calgary)
Geib, Tobias (Leibniz University Hannover)
Godsil, Chris (University of Waterloo)
Gosset, David (University of Waterloo)
Grunbaum, Francisco Alberto (University of California - Berkeley)
Guo, Krystal (Universite libre de Bruxelles)
Høyer, Peter (University of Calgary)
Jex, Igor (Czech Technical University)
Kirkland, Stephen (University of Manitoba)
Kiss, Tamás (Wigner Research Centre for Physics Hungary)
Kothari, Robin (Microsoft Research)
Lardizabal, Carlos (Federal University of Rio Grande do Sul)
Leung, Debbie (University of Waterloo)
Miki, Hiroshi (Meteorological College)
Plosker, Sarah (Brandon University)
Post, Sarah (Univesity of Hawaii)
Roland, Jérémie (Université libre de Bruxelles)
Tamon, Christino (Clarkson University)
Thiel, Felix (Bar-Ilan University)
Tsujimoto, Satoshi (Kyoto University)
Velazquez, Luis (Universidad de Zaragoza)
Vinet, Luc (Université de Montréal)
Werner, Albert (University of Copenhagen)
Werner, Reinhard (Leibniz Universität Hannover)
Zhan, Hanmeng (University of Waterloo)
Zhang, Xiaohong (University of Manitoba)

Modelling of Thin Liquid Films-Asymptotic Approach vs. Gradient Dynamics
April 28 - May 3, 2019

Organizers:

Uwe Thiele (Universität Münster)
Neil Balmforth (University of British Columbia)
Andrew Hazel (University of Manchester)
Chun Liu (Illinois Institute of Technology)

Thin films and shallow droplets of liquids on (soft) solid or liquid substrates are ubiquitous in nature and technology. We find them on window panes and plant leaves when it rains. Thin liquid films line our lungs and form the tear film that protects our eyes, as well as being essential for various coating and printing techniques. Mathematicians, physicists and engineers have been studying the dynamics of drops and liquid films for a long time and have developed approximate models, the so called thin-film equations, that are easier to solve than more exact models.

The workshop brought together experts from Applied Mathematics, Theoretical and Experimental Physics and Engineering disciplines to discuss the fundamental issues underlying these discrepancies and instigated the development of techniques to combine the approaches in a consistent way. Specifically, the scientists considered two related questions that must be resolved when establishing new thin-film models: Which modelling strategy should be followed, i.e., is it more important that a model is mathematically rigorous or that it is consistent with nonequilibrium thermodynamics?

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5148

Participants:

Ajaev, Vladimir (Southern Methodist University Dallas)
Archer, Andrew (Loughborough University)
Balmforth, Neil (University of British Columbia)
Chugunova, Marina (Claremont Graduate University)
Cimpeanu, Radu (University of Oxford)
Cuerno, Rodolfo (Universidad Carlos III de Madrid)
Falcon, Claudia (University of California Los Angeles)
Feng, James J (University of British Columbia)
Fontelos López, Marco Antonio (ICMAT)
Gonzalez, Alejandro G. (National University of Central Buenos Aires)
Gonzalez, Maria del Mar (Universidad Autonoma de Madrid)
Gurevich, Svetlana (University of Münster)
Hazel, Andrew (University of Manchester)
Hendy, Shaun (The University of Auckland)
Hewitt, Ian (University of Oxford)
John, Karin (Université Grenoble-Alpes)
Kondic, Lou (New Jersey Institute of Technology)
Krechetnikov, Rouslan (University of Alberta)
Kumar, Satish (University of Minnesota)
Li, Shuwang (Illinois Institute of Technology)
Lin, Te-Sheng (National Chiao Tung University)
Liu, Chun (Illinois Institute of Technology)
Man, Xingkun (Beihang University)
Manor, Ofer (Technion - Israel Institute of Technology Haifa)
Mueller, Marcus (University of Gottingen)
Peschka, Dirk (Weierstrass Institute Berlin)
Pierre-Louis, Olivier (Université Claude Bernard Lyon 1)
Rey, Alejandro D (McGill University)
Sellier, Mathieu (University of Canterbury)
Shearer, Michael (North Carolina State University)
Stokes, Yvonne (University of Adelaide)
Thiele, Uwe (Universität Münster)
Thompson, Alice (University of Manchester)
Wilson, Stephen (University of Strathclyde)
Witelski, Thomas (Duke University)
Young, Yuan-Nan (NJIT)

Nonlinear Geometric PDE's
May 5 - 10, 2019

Organizers:

Angela Pistoia (Sapienza Università di Roma)
Pierpaolo Esposito (Università di Roma Tre)
Monica Musso (University of Bath)

This five-day workshop gathered researchers in the areas of geometric analysis and geometric and nonlinear partial differential equations, ranging from geometric variational problems, which are local in nature, such as the Yamabe problem, the prescribing Q-curvature problem, the fully non-linear sigma(k)-Yamabe problem, to non-local problems, like the fractional Yamabe problem and the fraction Yamabe flow. Of particular interest is the study of blow-up phenomena occurring on points or higher dimensional sets.

Applications are intimately related for instance to theoretical physics (positive mass theorem in the theory of general relativity, Bose-Einstein condensates, Fluid-dynamics, Astrophysics), biology (pattern formations in reaction diffusion equations, diffusion process), material sciences.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5065

Participants:

Agostiniani, Virginia (Università di Verona)
Ao, Weiwei (Wuhan University)
Bartsch, Thomas (Universität Giessen)
Battaglia, Luca (Università di Roma Tre)
Catino, Giovanni (Politecnico di Milano)
D'Aprile, Teresa (Università di Roma Tor Vergata)
Davila, Juan (Universidad de Antioquia and Universidad de Chile)
De la Torre, Azahara (University of Freiburg)
del Pino, Manuel (University of Bath)
Duncan, Jonah (University of Oxford)
Esposito, Pierpaolo (Università di Roma Tre)
Fernandez, Juan Carlos (UNAM)
Fontelos López, Marco Antonio (ICMAT)
Gonzalez, Maria del Mar (Universidad Autonoma de Madrid)
Grossi, Massimo (Sapienza Università di Roma)
Jerrard, Bob (University of Toronto)
Jevnikar, Aleks (Scuola Normale Superiore di Pisa)
Kim, Seunghyeok (Hanyang University)
Kowalczyk, Michal (Universidad de Chile)
Malchiodi, Andrea (Scuola Normale Superiore di Pisa)
Mancini, Gabriele (Sapienza Università di Roma)
Martinazzi, Luca (University of Padova)
Mastrolia, Paolo (Università di Milano)
Mazzieri, Lorenzo (Università di Trento)
Molle, Riccardo (Università di Roma Tor Vergata)
Monticelli, Dario (Politecnico di Milano)
Moser, Roger (University of Bath)
Musso, Monica (University of Bath)
Premoselli, Bruno (Université Libre de Bruxelles)
Robert, Frédéric (Universite de Lorraine)
Saez, Mariel (Pontificia Universidad Catolica de Chile)
Tarantello, Gabriella (Roma Tor Vergata)
Terracini, Susanna (Università di Torino)
Vetois, Jerome (McGill University)

Women In Numerical Methods for PDEs and their Applications
May 12 - 17, 2019

Organizers:

Nilima Nigam (Simon Fraser University)
Marsha Berger (Courant Institute, New York University)
Mary-Catherine Kropinski (Simon Fraser University)
Anna-Karin Tornberg (KTH Royal Institute of Technology)

The numerical analysis of partial differential equations and their applications is a vast and vibrant area of scholarly inquiry, with deep connections to many fields of mathematics and computation. Computer simulations of models described by partial differential equations inform much of the technological progress in our lives, from how cars are designed to how animation in movies are created. This mathematical field is characterized by its relevance in science and engineering, and also by the numerous and foundational contributions made by women. Its importance is rivalled only by its breadth, which brings both advantages and challenges. A notable issue, which this workshop aims to address, is the formation of mathematical 'silos' within the field, and the consequent lack of professional networking/mentoring opportunities for women.

This workshop was a celebration of the many achievements of women in the field, and an opportunity to encourage the participation of young female researchers.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5189

Participants:

Almgren, Ann (LBL)
Berger, Marsha (Courant Institute, New York University)
Brenner, Sue (Louisiana State University)
Calhoun, Donna (Boise State)
DiPietro, Kelsey (University of Notre Dame)
Dong, Bo (UMass Dartmouth)
Fauci, Lisa (Tulane University)
Frederick, Christina (New Jersey Institute of Technology)
Gannon, Ashley (Florida State University)
Gerritsen, Margot (Stanford)
Gillman, Adrianna (University of Colorado Boulder)
Helzel, Christiane (U Dusseldorf)
Hohenegger, Christel (University of Utah)
Khatri, Shilpa (UC Merced)
Kreiss, Gunilla (Uppsala University)
Krivodonova, Lilia (University of Waterloo)
Larsson, Elisabeth (Uppsala U.)
Layton, Anita (University of Waterloo)
Leiderman, Karin (Colorado School of Mines)
Li, Fengyan (Rensselaer Polytechnic Institute)
Lim, Sookkyung (University of Cincinnati)
Lin, Yuexia (Harvard)
Lushi, Enkeleida (New Jersey Institute of Technology)
Marin, Oana (Argonne National Laboratory)
May, Sandra (TU Dortmund)
Nigam, Nilima (Simon Fraser University)
Persson, Anna (KTH Royal Institute of Technology)
Pollock, Sara (University of Florida)
Pugh, Mary (University of Toronto)
Schratz, Katharina (Karlsruhe Institute of Technology)
Thomases, Becca (University of California, Davis)
Tlupova, Svetlana (Farmingdale State College)
Tokman, Mayya (University of California - Merced)
Tornberg, Anna-Karin (KTH Royal Institute of Technology)
Woodward, Carol (Lawrence Livermore National Laboratory)
Yang, Yunan (New York University)

Optimal Neuroethology of Movement and Motor Control
May 19 - 24, 2019

Organizers:

Art Kuo (University of Calgary)
Alaa Ahmed (University of Colorado-Boulder)
Andy Ruina (Cornell University)
Manoj Srinivasan (Ohio State University)

'The only way humans and animals can affect the world is via movement... the only reason for the existence of the brain may be to ultimately affect movement' (Wolpert, 2011). Thus, understanding how goal-directed movement behavior is planned and controlled may give us a unique window into neuroscience. Thousands of experiments have shed light on movement behavior and a comparable number of mathematical models have been built to interpret these experiments. But the ultimate scientific objective is to distill this long catalog of insights into a few key principles of sensorimotor control and stitch together a broadly applicable mathematical theory from the myriad domain-specific models.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5235

Participants:

Ahmed, Alaa (University of Colorado-Boulder)
Blouin, Jean-Sébastien (UBC)
Cisek, Paul (University of Montréal)
Cowan, Noah (Johns Hopkins University)
De Groote, Friedl (KU Leuven)
Donelan, Max (Simon Fraser University)
Drugowitsch, Jan (Harvard University)
Gribble, Paul (Western University)
Guckenheimer, John (Cornell University)
Hartmann, Mitra (Northwestern University)
Kanso, Eva (University of Southern California)
Kilpatrick, Zachary (University of Colorado)
Kuo, Art (University of Calgary)
Kuo, Calvin (University of British Columbia)
Lemaire, Koen (University of Calgary)
Manohar, Sanjay (Oxford University)
Merel, Josh (DeepMind)
Polet, Delyle (University of Calgary)
Ruina, Andy (Cornell University)
Ryu, Hansol (University of Calgary)
Schrater , Paul (University of Minnesota)
Schroeder, Ryan (University of Calgary)
Seethapathi, Nidhi (University of Pennsylvania)
Selinger, Jessica (Queens University)
Srinivasan, Manoj (Ohio State University)
Sukumar, Shruthi (University of Colorado Boulder)
Taylor, Jordan (Princeton University)
Todorov, Emo (University of Washington)
Valero-Cuevas, Francisco (University of Southern California)
van de Panne, Michiel (UBC)
Wang, Jane (Cornell University)
Wong, Jeremy (University of Calgary)

Geometry of Real Polynomials, Convexity and Optimization
May 26 - 31, 2019

Organizers:

Levent Tunçel (University of Waterloo)
Greg Blekherman (Georgia Institute of Technology)
Daniel Plaumann (TU Dortmund University)
Cynthia Vinzant (North Carolina State University)

A systematic study of nonnegative polynomials already appeared in Minkowski's early work in the 19th century. Then, Hilbert, in his famous address at the International Congress of Mathematicians in 1900, asked for characterizations of nonnegative polynomials, including this question in his research agenda setting list of foundational problems. On the other hand, researchers like Petrovksy in the classical area of partial differential equations were laying the foundations for the theory of hyperbolic polynomials. By the beginning of the 21st century, these two areas started interacting deeply with optimization as well as theoretical computer science. This interaction recently led to solutions of many important open problems, new breakthroughs and applications.

This workshop brought together established experts and young researchers from the areas of real algebraic geometry, the geometry of polynomials, and convex and polynomial optimization, to review the most recent significant discoveries and strive to forge new connections.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5180

Participants:

Anari, Nima (Stanford University)
Basu, Saugata (Purdue University)
Blekherman, Greg (Georgia Institute of Technology)
Branden, Petter (KTH Royal Institute of Technology)
Cimpric, Jaka (University of Ljubljana)
Dressler, Mareike (UC San Diego)
El Khadir, Bachir (Princeton University)
Helton, Bill (UC San Diego)
Henrion, Didier (University of Toulouse)
Infusino, Maria (University of Konstanz)
Klep, Igor (The University of Auckland)
Kuhlmann, Salma (Universität Konstanz)
Kummer, Mario (TU Berlin Germany)
Lasserre, Jean-Bernard (LAAS-CNRS 7, Toulouse)
Manevich, Dimitri (TU Dortmund University Germany)
Murray, Riley (CalTech)
Naldi, Simone (Université de Limoges)
Nie, Jiawang (University of California San Diego)
Piontek, Roland (TU Dortmund University Germany)
Plaumann, Daniel (TU Dortmund University)
Putinar, Mihai (UCSB)
Renegar, James (Cornell University)
Riener, Cordian (University of Tromsø)
Roshchina, Vera (University of New South Wales)
Roy, Marie-Francoise (Universite de Rennes 1)
Safey El Din, Mohab (Sorbonne Univ. France)
Saunderson, James (Monash University)
Scheiderer, Claus (Univ-Konstanz Germany)
Scholten, Georgy (NCSU)
Shamovich, Eli (University of Waterloo)
Sinn, Rainer (Freie Universitaet Berlin)
Smith, Gregory G. (Queen's University)
Tetali, Prasad (Georgia Institute of Technology)
Thomas, Rekha (University of Washington)
Tunçel, Levent (University of Waterloo)
Vinnikov, Victor (Ben Gurion University of the Negev)
Vinzant, Cynthia (North Carolina State University)

Toward a Comprehensive, Integrated Framework for Advanced Statistical Analyses of Observational Studies
June 2 - 7, 2019

Organizers:

Michal Abrahamowicz (McGill University)
Richard Cook (University of Waterloo)
Marianne Huebner (Michigan State University)
Willi Sauerbrei (University of Freiburg)

This workshop was unique in bringing together statistical experts from across the world, whose joint expertise is essential to address the multiple, inter-twined analytical particular challenges from the structure and complexity of large databases analyzed in empirical sciences. The workshop built on the achievements of our 2016 BIRS workshop, by providing a systematic update on recent progress in development and systematic evaluation of novel statistical methodology in many areas essential for the analysis of observational population-based studies. The participants identified complex outstanding issues that require further analytical research, and devise strategies to tackle these challenges.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5198

Participants:

Abrahamowicz, Michal (McGill University)
Ambrogi, Federico (Università degli Studi di Milano)
Andersen, Per Kragh (University of Copenhagen)
Baillie, Mark (Novartis)
Beauchamp, Marie-Eve (Research Institute of the McGill University Health Centre)
Becher, Heiko (University Medical Center Hamburg-Eppendorf)
Benner, Axel (German Cancer Research Center)
Boeker, Martin (Med. Fakultät und Universitätsklinikum der Universität Freiburg)
Cadarette, Suzanne (University of Toronto)
Carroll, Orlagh (London School of Hygiene and Tropical Medicine)
De Bin, Riccardo (University of Oslo)
Deffner, Veronika (Ludwig-Maximilians-Universität München)
Didelez, Vanessa (Leibniz Institute for Prevention Research and Epidemiology - BIPS)
Freedman, Laurence (Gertner Institute for Epidemiology)
Gail, Mitchell (National Institutes of Health)
Goetghebeur, Els (University of Ghent)
Gustafson, Paul (University of British Columbia)
Harrell, Frank (Vanderbilt University)
Heinze, Georg (Medical University of Vienna)
Huebner, Marianne (Michigan State University)
Joly, Pierre (Université de Bordeaux)
Kammer, Michael (Medical University of Vienna)
Keogh, Ruth (London School of Hygiene and Tropical Medicine)
Kipnis, Victor (National Cancer Institute)
le Cessie, Saskia (Leiden University Medical Center)
McShane, Lisa (U.S. National Cancer Institute)
Pang, Menglan (McGill University)
Perperoglou, Aris (University of Essex)
Pohar-Perme, Maja (University of Ljubljana)
Rahnenführer, Jörg (TU Dortmund University)
Rauch, Geraldine (Charite - Universitatsmedizin Berlin)
Sauerbrei, Willi (Medical Center - University of Freiburg)
Schmid, Matthias (Universität Bonn)
Schmidt, Carsten (University Medicine of Greifswald)
Shaw, Pamela (University of Pennsylvania)
Steyerberg, Ewout (Erasmus MC)
Therneau, Terry (Mayo Clinic)
Vach, Werner (University Hospital Basel)
Van Calster, Ben (KU Leuven)
van Houwelingen, Hans (Leiden University Medical Center)
van Smeden, Maarten (Leiden University Medical Center)
Wallace, Michael (University of Waterloo)
Wallisch, Christine (Medical University of Vienna)

Women In Analysis
June 9 - 14, 2019

Organizers:

Donatella Danielli (Purdue University)

Irina Mitrea (Temple University)

Our intent was to start a Women in Analysis (WoAN) research group with a one week collaboration workshop at BIRS. The workshop hosted eight different research teams of five/six women each in different, but related, subject areas in Analysis and Partial Differential Equation. Each team was led by internationally recognized women experts in these fields. By building teams that included women at all career stages, the workshop formed mentoring and collaborative networks that strengthened the careers of all participants, developed new interdisciplinary research activities, trained junior mathematicians, and increased visibility and professional connections of participants. In addition, it offered an avenue for informed career development pertinent to women in analysis, and created a database of information and professional opportunities relevant to women in this mathematical field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5082

Participants:

Abatangelo, Laura (Universita di Milano Bicocca)
Balehowsky, Tracey (University of Helsinki)
Benguria, Soledad (University of Wisconsin-Madison)
Borcea, Liliana (University of Michigan)
Burchard, Almut (University of Toronto)
Burtscher, Annegret (Radboud University)
Cakoni, Fioralba (Rutgers University)
Clark, Carrie (University of Toronto)
Czubak, Magdalena (University of Colorado Boulder)
Danielli, Donatella (Purdue University)
Gaburro, Romina (University of Limerick)
Gallagher, Anne-Katrin (Gallagher Tool & Instrument)
Gupta, Purvi (Rutgers University)
Huang, Lan-Hsuan (University of Connecticut)
Kelleher, Casey (Princeton University)
Lanzani, Loredana (Syracuse University)
Mazzucato, Anna (Penn State University)
Mendelson, Dana (University of Chicago)
Mihaila, Cornelia (University of Chicago)
Mitrea, Irina (Temple University)
Mitrea, Dorina (University of Missouri)
Moskow, Shari (Drexel University)
Munasinghe, Samangi (Western Kentucky University)
Nahmod, Andrea (University of Massachusetts)
Nguyen, Xuan Hien (Iowa State University)
Ott, Katharine (Bates College)
Pavlovic, Natasa (University of Texas at Austin)
Pramanik, Malabika (University of British Columbia)
Sesum, Natasa (Rutgers University)
Shaw, Mei-Chi (University of Notre Dame)
Staffilani, Gigliola (Massachusetts Institute of Technology)
Terracini, Susanna (Università di Torino)
Vivas, Liz (Ohio State)
Xiao, Ling (University of Connecticut)
Yu, Xueying (Massachusetts Institute of Technology)

Bridging Cellular and Tissue Dynamics from Normal Development to Cancer: Mathematical, Computational, and Experimental Approaches
June 16 - 21, 2019

Organizers:

Andreas Buttenschoen (UBC)
Leah Edelstein-Keshet (UBC)
Elisabeth Rens (UBC)

In 2017, the Canadian Cancer Society reported that an estimated 206,200 Canadians will be diagnosed with cancer this year. Cancer has a devastating effect on the lives of many Canadians. The field is moving to a higher level by scaling these models up to tissues and collective cellular behaviour, while recognizing the importance of intra and inter-cellular signalling networks.

This development is giving rise to many new questions and challenges that this workshop explores. The critical objective of our workshop was to identify what is required from the three distinct communities to move forward so as to address these challenges. For this reason, our workshop gathered the top practitioners with track record of outstanding scientific innovations in this key area. The guiding question of this workshop was: How do we go beyond existing biological and mathematical models to develop a new understanding of tissue dynamics in normal and disease states?

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5080

Participants:

Beatrici, Carine (Paris-Diderot)
Bhaskar, Dhananjay (Brown University)
Boman, Bruce (University of Delaware)
Buttenschoen, Andreas (UBC)
Camley, Brian (Johns Hopkins University)
Campbell, Kyra (University of Sheffield)
Das, Moumita (Rochester Institute of Technology)
Deutsch, Andreas (TU Dresden)
Durney, Clinton (University of British Columbia)
Edelstein-Keshet, Leah (UBC)
Eftimie, Raluca (University of Dundee)
Feng, James (University of British Columbia)
Glazier, James (Professor)
Hall, Meghan (University of Alberta)
Hayer, Arnold (McGill University)
Heiland, Randy (Indiana University)
Hillen, Thomas (University of Alberta)
Holmes, William (Vanderbilt University)
Iber, Dagamar (ETH Zurich)
Jilkine, Alexandra (Notre Dame)
Khadra, Anmar (McGill University)
Kulesa, Paul (Stowers Institute for Medical Research)
Kursawe, Jochen (University of Manchester)
Lander, Arthur (University of California Irvine)
Madzvamuse, Anotida (University of Sussex)
Maree, Stan (Cardiff University)
McGuigan, Alison (University of Toronto)
Merks, Roeland (Leiden University)
Mogilner, Alex (Courant Institute NYU)
Munro, Ed (University of Chicago)
Newby, Jay (University of Alberta)
Painter, Kevin (Heriot-Watt University)
Palsson, Eirikur (Simon Fraser University)
Ponce Bobadilla, Ana Victoria (University of Heidelberg)
Rejniak, Katarzyna (Moffitt Cancer Center & Research Insitute)
Rens, Elisabeth (University of British Columbia)
Rhodes, Adam (University of Alberta)
Schumacher, Linus (University of Edinburgh)
Stepien, Tracy (University of Arizona)
Volkening, Alexandria (Ohio State University)
Wong, Ian (Brown University)
Yue, Haicen (NYU)

Reconstruction Methods for Inverse Problems
June 23 - 28, 2019

Organizers:

Elena Beretta (NYU Abu Dhabi & Politecnico di Milano)
Uri Ascher (University of British Columbia)
Otmar Scherzer (University of Vienna)
Luminita Vese (University of California - Los Angeles)

Inverse problems require to determine the cause from a set of indirect observations. Such problems appear in medical imaging, non destructive testing of materials, computerized tomography, source reconstructions in acoustics, computer vision and geophysics, to mention but a few. The 21st century is the golden age of computer imaging: Measurement devices have become enormously powerful and huge amounts of data are recorded at every eye glimpse. Moreover, computer technology has developed to such a high degree of efficiency that the evaluation of such an enormous amount of data has become possible *if* adequate mathematical and computational tools are used. Recently, the community has been exposed to fundamentally new mathematical models (such as learning), which stimulated exciting theoretical developments and new computational algorithms for solving complicated large scale inverse problems. This workshop surveyed modern and identified new mathematical and computational developments for tackling such problems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5092

Participants:

Alberti, Giovanni S. (University of Genoa)
Arridge, Simon (University College London)
Ascher, Uri (University of British Columbia)
Aspri, Andrea (RICAM)
Beretta, Elena (NYU Abu Dhabi & Politecnico di Milano)
Cakoni, Fioralba (Rutgers University)
Calvetti, Daniela (Case Western Reserve University)
Cerutti, MariaCristina (Politecnico of Milan)
Debroux, Noémie (University of Cambridge)
Elbau, Peter (University of Vienna)
Francini, Elisa (Università di Firenze)
Gaburro, Romina (University of Limerick)
Gandolfi, Alberto (NYU Abu Dhabi)
Grasmair, Markus (Norwegian University of Science and Technology)
Guo, Weihong (Case Western Reserve University)
Haber, Eldad (The University of British Columbia)
Hofmann, Bernd (Technische Universität Chemnitz)
Kaipio, Jari (University of Auckland)
Kaltenbacher, Barbara (University of Klagenfurt)
Kim, Yunho (Ulsan National Institute of Science and Technology - South Korea)
Kuchment, Peter (Texas A&M University)
Leitao, Antonio (University of Floranopolis)
Mazzucato, Anna (Penn State University)
Moskow, Shari (Drexel University)
Nachman, Adrian (University of Toronto)
Nashed, Zuhair (University of Central Florida)
Plato, Robert (University of Siegen)
Ratti, Luca (University of Helsinki)
Rondi, Luca (Università degli Studi di Milano)
Ruthotto, Lars (Emory University)
Santacesaria, Matteo (University of Genoa)
Scherzer, Otmar (University of Vienna)
Schillings, Claudia (University of Mannheim)
Sherina, Ekaterina (University of Vienna)
Somersalo, Erkki (Case Western)
Steidl, Gabriele (Technical University of Kaiserslautern)
Verani, Marco (Politecnico di Milano)

Advances in Dispersive Equations: Challenges & Perspectives
June 30 - July 5, 2019

Organizers:

Slim Ibrahim (University of Victoria)
Stephen Gustafson (University of British Columbia)
Kenji Nakanishi (Kyoto University)

This workshop provided a forum for international experts in the mathematical analysis of nonlinear dispersive partial differential equations — a type of equation which models wave-like behaviour in such diverse physical settings as water waves, Bose-Einstein condensates, gravitation, lasers, and ferromagnets — to survey the state-of-the art, and exchange ideas on promising future directions of research. The main themes included global dynamics and soliton resolution; wave turbulence and KAM theory; stochastic waves; and numerical methods for dispersive equations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5233

Participants:

Akahori, Takafumi (Shizuoka University)
Arbunich, Jack (University of Toronto)
Azaiez, Asma (New York University Abu Dhabi)
Bahri, Yakine (University of Victoria)
Bejenaru, Ioan (University of California - San Diego)
Berti, Massimiliano (Sissa)
Bizon, Piotr (Jagiellonian University)
Bringmann, Bjoern (University of California - Los Angeles)
Buckmaster, Tristan (Princeton University)
Collot, Charles (New York University)
Deconinck, Bernard (University of Washington)
Deng, Yu (University of Southern California)
Deng, Yanxia (University of Victoria)
Fibich, Gadi (Tel Aviv University)
Ghoul, Tej-Eddine (New York university Abu dhabi)
Grébert, Benoît (Université de Nantes)
Gustafson, Stephen (University of British Columbia)
Ibrahim, Slim (University of Victoria)
Kirkpatrick, Kay (University of Illinois)
Koch, Herbert (University of Bonn)
Krieger, Joachim (Ecole Polytechnique Federale de Lausanne)
Mizumachi, Tetsu (Hiroshima University)
Nakanishi, Kenji (Kyoto University)
Pausader, Benoit (Brown University)
Pelinovski, Dmitry (McMaster University)
Phan, Tuoc-Van (University of Tennessee)
Rosenzweig, Matthew (University of Texas - Austin)
Sterbenz, Jacob (University of California - San Diego)
Tsai, Tai-Peng (University of British Columbia)
Tsutsumi, Yoshio (Kyoto University)
Visan, Monica (University of California - Los Angeles)
Wang, Li (University of British Columbia)

Algebraic Techniques in Computational Complexity
July 7 - 12, 2019

Organizers:

Valentine Kabanets (Simon Fraser University)
Russell Impagliazzo (University of California San Diego)
Toniann 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
https://www.birs.ca/events/2019/5-day-workshops/19w5088

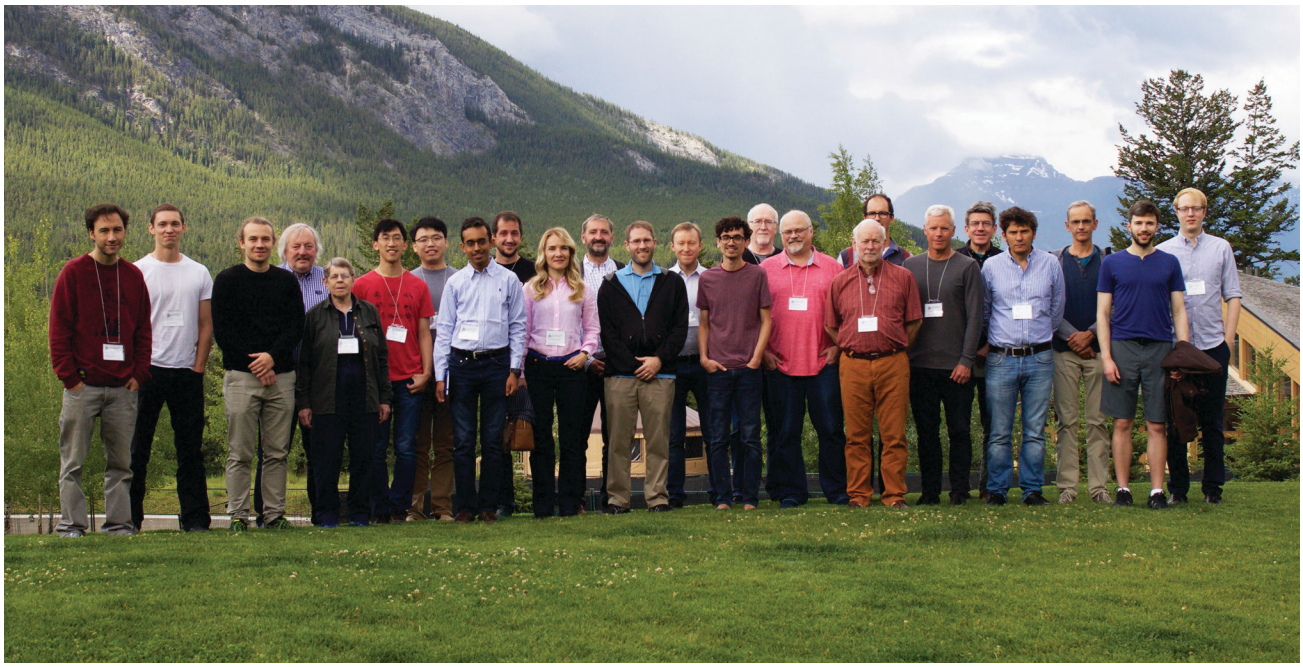
Participants:

Aaronson, Scott (UT Austin)
Alman, Josh (MIT)
Barak, Boaz (Harvard)
Beame, Paul (University of Washington)
Bun, Mark (Boston University)
Chattopadhyay, Arkadev (Tata Institute of Fundamental Research)
Chattopadhyay, Eshan (Cornell University and IAS)
Cohen, Gil (Tel Aviv University)
de Rezende, Susanna (Czech Academy of Sciences)
Gal, Anna (University of Texas at Austin)
Goos, Mika (Stanford University)
Grochow, Joshua (University of Colorado at Boulder)
Gurjar, Rohit (IIT Bombay)
Hatami, Hamed (McGill University)
Hoza, William (UT Austin)
Ikenmeyer, Christian (Max Planck Institute for Software Systems)
Impagliazzo, Russell (University of California San Diego)
Kabanets, Valentine (Simon Fraser University)
Kayal, Neeraj (MSR India)
Kolokolova, Antonina (Memorial University of Newfoundland)
Koroth, Sajin (Simon Fraser University)
Lovett, Shachar (University of California San Diego)
Meir, Or (University of Haifa)
Minzer, Dor (Institute for Advanced Study - Princeton)
Moshkovitz, Dana (University of Texas - Austin)
O'Donnell, Ryan (Carnegie Melon University)
Oliveira, Rafael (University of Toronto)
Oshman, Rotem (Tel Aviv University)
Pitassi, Toniann (University of Toronto)
Rossman, Benjamin (University of Toronto)
Saraf, Shubhangi (Rutgers University)
Schramm, Tselil (Harvard/MIT)
Shinkar, Igor (Simon Fraser University)
Shirley, Morgan (University of Toronto)
Shpilka, Amir (Tel Aviv U)
Williams, Ryan (MIT)
Zuiddam, Jeroen (Institute for Advanced Study - Princeton)

The Many Faceted Connes Embedding Problem
July 14 - 19, 2019

Organizers:

Mary Beth Ruskai (University of Vermont)
Marius Junge (University of Illinois at Urbana-Champaign)
Carlos Palazuelos (Universidad Complutense de Madrid)
Vern Paulsen (University of Waterloo)



This workshop was motivated by the recent ferment of activity on the Connes embedding problem, which has been a major open question for over 40 years. During that time, the problem was reformulated in several different areas of mathematics. In 2011, it was shown to be connected to some basic questions in quantum theory, which led to the realization that it also has important implications in computer science. There was a major breakthrough in 2016 when a new type of non-local game was constructed which solved a related question and has important implications for our understanding of quantum correlations. Participants from mathematics, quantum information theory, and computer science gathered to learn about the most recent developments and the implications for their fields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5163

Participants:

Bene Watts, Adam (MIT)
Brannan, Michael (Texas A&M University)
Briët, Jop (Center for Mathematics and Computer Science (CWI))
Cleve, Richard (University of Waterloo)
Coladangelo, Andrea (Caltech)
Coudron, Matthew (University of Waterloo)
Dor On, Adam (University of Copenhagen)
Farenick, Douglas (University of Regina)
Gao, Li (Texas A&M University College Station)
Hilsum, Michel (CNRS)
Junge, Marius (University of Illinois at Urbana-Champaign)
Kubicki, Aleksander M. (Universitat de València)
Levene, Rupert (University College Dublin)
Lledó, Fernando (Universidad Carlos III de Madrid)
Musat, Magdalena (University of Copenhagen)
Natarajan, Anand (Caltech)
Palazuelos, Carlos (Universidad Complutense de Madrid)
Paulsen, Vern (University of Waterloo)
Pérez-García, David (Complutense University of Madrid - ICMAT)
Rordam, Mikael (University of Copenhagen)
Ruskai, Mary Beth (University of Vermont)
Russell, Travis (USMA West Point)
Sinclair, Thomas (Purdue)
Szarek, Stanislaw (Case Western Reserve University)
Todorov, Ivan (Queen's University Belfast)
Vidick, Thomas (California Institute of Technology)
Voiculescu, Dan (University of California, Berkeley)
Werner, Reinhard (Leibniz Universität Hannover)
Winter, Andreas (Universitat Autonoma de Barcelona)
Wright, John (Massachusetts Institute of Technology)
Yuen, Henry (University of Toronto)

Algebraic and Statistical ways into Quantum Resource Theories
July 21 - 26, 2019

Organizers:

Gilad Gour (University of Calgary)
Eric Chitambar (University of Illinois)
Francesco Buscemi (Nagoya University)

The 2019 BIRS workshop aimed to pave new algebraic and statistical ways into quantum resource theories. Forty-two world-renown researchers from the three areas of quantum information science, mathematical statistics, and operator theory united to advance the subject of generalized resource theories. In the world of quantum mechanics, objects can demonstrate highly counter-intuitive behavior, such as particles acting like waves. Yet, scientists are now discovering revolutionary ways to utilize quantum phenomena in computing and communication technologies. The mere curiosities of quantum mechanics have been elevated to the level of physical resources. In this workshop, known mathematical techniques were introduced to the study of quantum resources, and conversely, open problems in quantum resource theories motivated novel areas of mathematics. By fostering the exchange of fresh ideas and establishing new collaborations, this workshop stimulated cutting-edge research in these exciting fields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5120

Participants:

Acin, Antonio (ICFO The Institute of Photonic Sciences)
Adesso, Gerardo (University of Nottingham)
Anshu, Anurag (Perimeter Institute)
Berta, Mario (Imperial College London)
Bisio, Alessandro (University of Pavia)
Boes, Paul (Freie Universität Berlin)
Buscemi, Francesco (Nagoya University)
Chitambar, Eric (University of Illinois)
Dall'Arno, Michele (National University of Singapore)
Datta, Nilanjana (Cambridge University)
de Vicente, Julio (Universidad Carlos III de Madrid)
Gao, Li (Texas A&M University College Station)
Girard, Mark (University of Waterloo)
Gonda, Tomas (Perimeter Institute for Theoretical Physics)
Gour, Gilad (University of Calgary)
Hebenstreit, Martin (University of Innsbruck)
Hsieh, Min-Hsiu (University of Technology Sydney)
Jencova, Anna (Mathematical Institute of the Slovak Academy of Sciences)
Khatri, Sumeet (Louisiana State University)
Kim, Jeong San (Kyung Hee University)
Lami, Ludovico (University of Nottingham)
LaRacuente, Nicholas (University of Illinois Urbana-Champaign)
Leditzky, Felix (University of Colorado Boulder)
Marvian, Iman (Duke University)
Matsumoto, Keiji (National Informatics Institute - Tokyo)
Narasimhachar, Varun (Nanyang Technological University)
Paulsen, Vern (University of Waterloo)
Plosker, Sarah (Brandon University)
Regula, Bartosz (Nanyang Technological University)
Rosset, Denis (Perimeter Institute)
Saxena, Gaurav (University of Calgary)
Scandolo, Carlo Maria (University of Calgary)
Sengupta, Kuntal (University of Calgary)
Sparaciari, Carlo (Imperial College London)
Srinivasan, Priyaa (University of Calgary)
Takagi, Ryuji (Massachusetts Institute of Technology)
Theurer, Thomas (Ulm University)
Tomamichel, Marco (University of Technology Sydney)
Wang, Xin (University of Maryland)
Wilde, Mark (Louisiana State University)
Winter, Andreas (Universitat Autonoma de Barcelona)
Wolf, Michael (Technische Universitaet Muenchen)
Xiao, Yunlong (University of Calgary)
Yang, Dong (University of Bergen and China Jiliang University)
Yunger Halpern, Nicole (Harvard University)
Zibakhshshabgahi, Rana (University of Calgary)

New Mathematical Methods for Complex Systems in Ecology July 28 - August 2, 2019

Organizers:

Andrew Morozov (University of Leicester)
Alan Hastings (University of California - Davis)
Mark Lewis (University of Alberta)

Mathematical modelling in ecology has a long and illustrious history in explaining various aspects of complex dynamics of ecosystems. Mathematical tools used in modelling have been constantly evolving to become more and more efficient. New challenges and ever increasing demand for improving the predictive power of models and for a better understanding of the complexity of the underlying systems have inspired the emergence of novel research areas.

This workshop brought together applied mathematicians, researchers in mathematical ecology and theoretical ecologists to address these issues in order to clarify the state-of-the-art in this field, to refine the existing challenges and problems, to highlight important recent findings, and to develop a roadmap to facilitate fast future progress in mathematics of complex ecosystems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5108

Participants:

Abbott, Karen (Case Western Reserve University)
Adamson, Matthew (University of Osnabrueck)
Allen, Linda (Texas Tech University)
Bearup, Daniel (University of Kent)
Bolker, Benjamin (McMaster University)
Cosner, Chris (University of Miami)
Cuddington, Kim (University of Waterloo)
Dakos, Vasilis (Université de Montpellier)
DeAngelis, Donald (University of Miami)
Franco, Daniel (Universidad Nacional de Educación a Distancia)
Gellner, Gabriel (University of Guelph)
Greenwood, Priscilla (University of British Colombia)
Gross, Thilo (UC Davis)
Hastings, Alan (University of California at Davis)
Hilker, Frank (Osnabrück University)
Igoshin, Oleg (Rice University)
Juan, Lourdes (Texas Tech University)
Kooi, Bob (VU Amsterdam)
Kuehn, Christian (Technical University of Munich)
Lai, Ying-Cheng (Arizona State University)
Lenhart, Suzanne (University of Tennessee - Knoxville)
Lewis, Mark (University of Alberta)
Lutscher, Frithjof (University of Ottawa)
McCann, Kevin (University of Guelph)
Meron, Ehud (Ben-Gurion University)
Miller, Judith (Georgetown University)
Morozov, Andrew (University of Leicester)
Munch, Steve (UC Santa Cruz)
Petrovskaya, Natalia (University of Birmingham)
Petrovskii, Sergei (University of Leicester)
Rogers, Tanya (UC Santa Cruz)
Rossberg, Axel (Queen Mary University London)
Sadhu, Susmita (Georgia College and State University)
Schreiber, Sebastian (University of California - Davis)
Sudakov, Ivan (University of Dayton)
Tang, Si (Lehigh University)
Tyson, Rebecca (University of British Columbia - Okanagan)
Venturino, Ezio (Universita di Torino)
Wieczorek, Sebastian (University College Cork)

From Many Body Problems to Random Matrices
August 4 - 9, 2019

Organizers:

Tai-Peng Tsai (University of British Columbia)
Paul Bourgade (New York University)
Laszlo Erdos (Institute of Science and Technology Austria)
Jeremy Quastel (University of Toronto)

Random matrix theory is a vibrant area of probability theory and mathematical physics, with applications across mathematics, physics and engineering. The workshop focussed on the study of dynamics of many body systems, in order to deepen the connections between random matrix theory and the KPZ fixed point, a paradigm for various growth models. This is a very active field, since similar exotic distributions strikingly appear in both domains, but our understanding for the reasons of this analogy is still superficial.

In recent years, the detailed study of the Dyson Brownian motion dynamics led to a period of intense research activity on random matrix universality, and our understanding continues to expand at a fast pace. This meeting aimed at enlarging the range of applications of the dynamics idea to approach universal properties of stochastic growth models and other many body systems. This workshop brought together various groups of experts, in probability and mathematical physics, working on the theory of random matrices and stochastic partial differential equations to discuss the most recent results and open problems in the field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5176

Participants:

Adhikari, Arka (Harvard)
Aggarwal, Amol (Harvard)
Alt, Johannes (University of Geneva)
Bauerschmidt, Roland (Cambridge University)
Benigni, Lucas (Paris 7)
Bourgade, Paul (New York University)
Brennecke, Christian (Harvard)
Cipolloni, Giorgio (Institute of Science and Technology Austria)
Deift, Percy (New York University)
Dembo, Amir (Stanford)
Ding, Jian (University of Pennsylvania)
Elgart, Alexander (Virginia Tech)
Erdos, Laszlo (Institute of Science and Technology Austria)
Kemp, Todd (University of California, San Diego)
Knowles, Antti (Universite de Geneve)
Landon, Benjamin (Massachusetts Institute of Technology)
Lopatto, Patrick (Harvard University)
Nachtergaele, Bruno (University of California Davis)
Novak, Jonathan (University of California - San Diego)
Olla, Stefano (Université Paris Dauphine and PSL Research University)
Quastel, Jeremy (University of Toronto)
Sarkar, Sourav (University of Toronto)
Schlein, Benjamin (Universitat Zurich)
Schnelli, Kevin (KTH Royal Institute of Technology)
Shcherbyna, Mariya (Institute Low Temperature Physics Kharkov)
Shcherbyna, Tatyana (Princeton University)
Solovej, Jan Phillip (University of Copenhagen)
Sosoe, Philippe (Cornell University)
Spencer, Thomas (Institute for Advanced Studies - USA)
Strain, Robert (University of Pennsylvania - Philadelphia)
Sun, Nike (MIT)
Tsai, Tai-Peng (University of British Columbia)
Varadhan, Srinivasa (New York University)
Yau, Horng-Tzer (Harvard University)
Yau, Morris (University of California, Berkeley)

Convex Integration in PDEs, Geometry, and Variational Calculus
August 11 - 16, 2019

Organizers:

Emil Wiedemann (Universität Ulm)
Eduard Feireisl (Academy of Sciences of the Czech Republic)
Marta Lewicka (University of Pittsburgh)

There is vast ongoing interest in the so-called technique of convex integration in several areas of mathematics, as demonstrated by diverse recent contributions. Notably, the seemingly unrelated fields of materials science, fluid dynamics and symplectic geometry enjoyed significant advances through this method, to mention a few: flexibility of the energy-minimizing solutions in the description of shape memory alloys, the resolution of Onsager's conjecture formulated in the realm of statistical mechanics, or the classification of overtwisted contact structures in all dimensions; all based on Gromov's h-principle and further appropriate extensions of Nash and Kuiper's iterative convex integration scheme developed for the classical isometric embedding problem in Riemannian geometry.

This 5-day workshop brought together experts from geometry, variational calculus and mathematical fluid dynamics to share existing knowledge as well as to open up new perspectives and collaborations across different mathematical subfields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5130

Participants:

Cheskidov, Alexey (University of Chicago Illinois)
Dai, Mimi (University of Illinois at Chicago)
Daneri, Sara (Universität Erlangen)
Feireisl, Eduard (Academy of Sciences of the Czech Republic)
Gwiazda, Piotr (Polish Academy of Sciences)
Hofmanova, Martina (Bielefeld University)
Inauen, Dominik (Universität Zürich)
Kim, Seonghak (Kyungpook National University)
Kim, Young-Heon (University of British Columbia)
Kreml, Ondřej (Institute of Mathematics, Czech Academy of Sciences)
Krupa, Sam (The University of Texas at Austin)
Lewicka, Marta (University of Pittburgh)
Markfelder, Simon (University of Würzburg)
Rüland, Angkana (Max Planck Institute for Mathematics in the Sciences)
Shvydkoy, Roman (University of Illinois at Chicago)
Świerczewska-Gwiazda, Agnieszka (University of Warsaw)
Weser, Daniel (University of Texas at Austin)
Wiedemann, Emil (Universität Ulm)
Yan, Baisheng (Michigan State University)
Zillinger, Christian (University of Southern California)

Mutations: Mirror Symmetry, Deformations, and Combinatorics
August 11 - 16, 2019

Organizers:

Johannes Hofscheier (McMaster University)
Akihiro Higashitani (Osaka University)
Alexander Kasprzyk (The University of Nottingham)

Mutations, introduced by Fomin and Zelevinsky in 2001, play an important role in a broad range of mathematical areas: from theoretical physics to algebraic geometry; from deformation theory to convex geometry. The basic idea of mutation is to provide an iterative way of modifying one “good” mathematical object to obtain another “good” mathematical object. Starting from an initial seed, successive mutations allow us to obtain more and more information about the objects being studied. Although the original approach by Fomin and Zelevinsky was purely algebraic, mutations are rapidly finding their way into the broader mathematical landscape. Especially interesting is recent progress towards classifying fundamental geometric spaces called Fano manifolds. Central to this new approach, which draws on ideas from Mirror Symmetry, is a detailed understanding of mutation. Building bridges between the different viewpoints and techniques is essential if this approach is to succeed.

The workshop brought together world-leading experts from many areas of pure mathematics who might not otherwise interact. The common theme was the presence of mutations in our work, with the focus on overlaps with Mirror Symmetry, deformation theory, and combinatorics. We exchanged information on recent developments, and worked together on common problems with the aim of furthering our understanding of mutations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5179

Participants:

Bossinger, Lara (UNAM)
Cheung, Man-Wai (Harvard University)
Corti, Alessio (Imperial College London)
Ducat, Tom (University of Bristol)
Fujita, Naoki (University of Tokyo)
Gagliardi, Giuliano (Leibniz Universität Hannover)
Higashitani, Akihiro (Osaka University)
Hofscheier, Johannes (McMaster University)
Ilten, Nathan (Simon Fraser University)
Ito, Yukari (The University of Tokyo)
Kalashnikov, Elana (Imperial College London)
Kaloghiros, Anne-Sophie (Brunel University)
Kasprzyk, Alexander (The University of Nottingham)
Mincheva, Kalina (Yale University)
Monin, Leonid (University of Toronto)
Nakajima, Yusuke (Kavli Institute for the Physics and Mathematics of the Universe)
Petracci, Andrea (Freie Universität Berlin)
Portakal, Irem (Otto-von-Guericke-Universität Magdeburg)
Prince, Thomas (University of Oxford)
Schaller, Karin (Freie Universität Berlin)
Srivastava, Ashish (St. Louis University)

Charge and Energy Transfer Processes: Open Problems in Open Quantum Systems
August 18 - 23, 2019

Organizers:

Marco Merkli (Memorial University of Newfoundland)
Aaron Kelly (Dalhousie University)
Dvira Segal (University of Toronto)

We brought together leaders from the Mathematical Physics and Chemical Physics communities who were interested in the theory of open quantum systems dynamics with a focus on charge and energy transfer dynamics in condensed phases systems. Participants had research expertise in analytical and computational method development in the fields of mathematical physics, chemical dynamics, quantum decoherence, dissipation and transport, quantum thermodynamics, quantum statistical mechanics, and quantum many-body physics.

The overarching goal of the workshop was to open the dialog between mathematicians, physicists and chemists, to identify the important open theoretical problems surrounding transfer processes and to craft solution strategies. The workshop helped breaking “language barriers” which prevent mathematicians from applying their knowledge to relevant chemistry problems and which prohibit chemists from applying new mathematical tools.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5016

Participants:

Anders, Janet (University of Exeter)
Aoki, Takaaki (The University of Tokyo, AIST)
Bru, Jean-Bernard (University of the Basque Country & BCAM & Ikerbasque)
Brumer, Paul (University of Toronto)
Cao, Jianshu (Massachusetts Institute of Technology)
Celardo, Giuseppe Luca (IFUAP-BUAP Puebla)
Cerrillo, Javier (Technical University Berlin)
Coker, David (Boston University)
Correa, Luis A. (University of Nottingham)
Fujihashi, Yuta (National Institutes of Natural Sciences - Japan)
Gauger, Erik (Heriot-Watt University)
Haack, Géraldine (University of Geneva)
Hanna, Gabriel (University of Alberta)
Harter, Andrew Kent (University of Tokyo)
Hatano, Naomichi (The University of Tokyo)
Joye, Alain (Institut Fourier U. Grenoble-Alpes)
Keeling, Jonathan (University of St Andrews)
Kelly, Aaron (Dalhousie University)
Koch, Christiane (University of Kassel)
Kosloff, Ronnie (Hebrew University of Jerusalem)
Krems, Roman (University of British Columbia)
Limmer, David (UC Berkeley)
Merkli, Marco (Memorial University of Newfoundland)
Nazir, Ahsan (University of Manchester)
Nitzan, Abraham (University of Pennsylvania)
Petruccione, Francesco (University of KwaZulu-Natal)
Plenio, Martin B (University of Ulm)
Segal, Dvira (University of Toronto)
Shi, Qiang (Institute of Chemistry, Chinese Academy of Sciences)
Spehner, Dominique (Universidad de Concepción)
Strasberg, Philipp (Universitat Autonoma de Barcelona)
Thorwart, Michael (Universität Hamburg)

Groups and Geometries
August 25 - 30, 2019

Organizers:

Martin Liebeck (Imperial College)
Inna Capdebosq (University of Warwick)
Bernhard Muehlherr (University of Giessen)

Group theory is an abstract subject, but it is also the mathematical way to investigate symmetry. Thus many problems from various areas of mathematics which involve some sort of symmetry are susceptible to the application of group theory.

The basic building blocks of all finite groups are the simple groups, and the finite simple groups were classified in one of the most monumental mathematical achievements of the 20th century, involving many researchers over a period of many years. One of the main topics of the meeting was the area of Fusion Systems. This topic originated in topology, but is now having a growing impact in finite group theory. One potential far-reaching application is a new proof of a major part of the classification of finite simple groups. Another theme was the connections between groups and geometrical structures such as Bruhat-Tits buildings; here the groups involved are not just finite simple groups, but many other types of algebraic and arithmetic groups. The third theme was some spectacular applications of group theory, of which there are many diverse examples, in number theory, algebraic geometry, probability and combinatorics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5046

Participants:

Aschbacher, Michael (California Institute of Technology)
Baumeister, Barbara (Universitaet Bielefeld)
Burness, Tim (University of Bristol)
Chermak, Andrew (Kansas State University)
De Medts, Tom (Ghent University)
De Schepper, Anneleen (Ghent University)
Eamonn, O'Brien (University of Auckland)
Gill, Nick (Univ of South Wales)
Grazian, Valentina (Università degli Studi di Padova)
Grüninger, Matthias (University of Gießen)
Henke, Ellen (University of Aberdeen)
Kessar, Radha (University of London)
Köhl, Ralf (Universität Gießen)
Liebeck, Martin (Imperial College)
Lynd, Justin (University of Louisiana at Lafayette)
Lyons, Richard (Rutgers University)
Malle, Gunter (Technische Universität Kaiserslautern)
Marquis, Timothee (Université Catholique de Louvain)
McNinch, George (Tufts University)
Meulewaeter, Jeroen (Ghent University)
Morgan, Luke (University of Primorksa)
Muehlherr, Bernhard (University of Giessen)
Oliver, Bob (Universite Paris 13)
Parker, Chris (University of Birmingham)
Praeger, Cheryl (University of Western Australia)
Przytycki, Piotr (McGill)
Reichstein, Zinovy (University of British Columbia)
Roney Dougal, Colva (University of St Andrews)
Schillewaert, Jeroen (University of Auckland)
Segev, Yoav (Ben Gurion University)
Semeraro, Jason (University of Leicester)
Solomon, Ronald Mark (The Ohio State University)
Stewart, David (Newcastle University)
Stroth, Gernot (University of Halle, Germany)
Thomas, Adam (University of Bristol)
Tiep, Pham (Rutgers University)
van Maldeghem, Hendrik (Ghent University)
Waldecker, Rebecca (MLU Halle-Wittenberg)
Weiss, Richard (Tufts University)

Workshop on Probabilistic and Extremal Combinatorics
September 1 - 6, 2019

Organizers:

Benny Sudakov (ETH - Zurich)
Penny Haxell (University of Waterloo)
Michael Krivelevich (Tel Aviv University)

Combinatorics, sometimes also called Discrete Mathematics, is a branch of mathematics focusing on the study of discrete objects and their properties. Although Combinatorics is probably as old as the human ability to count, the field experienced tremendous growth during the last fifty years and is one of the most modern in today's Mathematics, with numerous connections to different disciplines and various practical applications, ranging from designing VLSI chips to modeling complex social networks. The workshop discussed some of latest developments in these fields, their connections and applications.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5009

Participants:

Alon, Noga (Princeton University & Tel Aviv University)
Angel, Omer (University of British Columbia)
Balogh, Jozsef (University of Illinois at Urbana)
Boettcher, Julia (London School of Economics and Political Science)
Bucic, Matija (ETH Zurich)
Bukh, Boris (Carnegie Mellon University)
Conlon, David (California Institute of Technology)
Das, Shagnik (Freie Universität Berlin)
Ferber, Asaf (MIT)
Fox, Jacob (Stanford University)
Friedgut, Ehud (Weizmann Institute)
Gishboliner, Lior (Tel Aviv University)
Haxell, Penny (University of Waterloo)
Huang, Hao (Emory university)
Kahn, Jeff (Rutgers University)
Kang, Mihyun (TU Graz)
Keevash, Peter (Oxford University)
Kostochka, Alexandr (University of Illinois - Urbana-Champaign)
Kral, Daniel (Masaryk University)
Krivelevich, Michael (Tel Aviv University)
Kronenberg, Gal (Tel Aviv University)
Kwan, Matthew (Stanford University)
Letzter, Shoham (ETH Zurich)
Liebenau, Anita (UNSW Sydney)
Linial, Nathan (Hebrew University of Jerusalem)
Montgomery, Richard (Birmingham University)
Mubayi, Dhruv (University of Illinois at Chicago)
Narayanan, Bhargav (Rutgers University)
Pokrovskiy, Alexey (Birkbeck University)
Sauermann, Lisa (Stanford University)
Schacht, Mathias (University of Hamburg and Yale University)
Shapira, Asaf (Tel Aviv University)
Shikhelman, Clara (Oxford University)
Skokan, Jozef (LSE)
Solymosi, Jozsef (University of British Columbia)
Sudakov, Benny (ETH - Zurich)
Szabo, Tibor (Freie Universität Berlin)
Tyomkyn, Mykhaylo (University of Oxford)
Verstraete, Jacques (UCSD)
Wagner, Zsolt Adam (ETH)
Zhao, Yufei (MIT)
Zhao, Yi (Georgia State University)

Topology and Measure in Dynamics and Operator Algebras
September 8 - 13, 2019

Organizers:

David Kerr (Texas A&M University)
George Elliott (University of Toronto)
Thierry Giordano (University of Ottawa)
Xin Li (Queen Mary University of London)

The theory of operator algebras was conceived by von Neumann in the 1920s as a rigorous framework for quantum mechanics and the idea of continuous dimensionality. Since that time the subject has enjoyed a rich and multifaceted relationship with both measurable and topological dynamics, which classically study the time evolution of physical systems and provide coordinate systems for understanding operator-algebraic structure. Recent advances in all of these areas have called for deeper and more coordinated investigations into the relations between measure and topology, and the workshop provided a dedicated occasion for the pursuit of this program.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5073

Participants:

Archey, Dawn (University of Detroit Mercy)
Blackadar, Bruce (University of Nevada at Reno)
Brenken, Berndt (University of Calgary)
Carrión, José (Texas Christian University)
Castillejos, Jorge (KU Leuven)
Chung, Nhan-Phu (Sungkyunkwan University)
Courtney, Kristin (University of Münster)
Elliott, George (University of Toronto)
Evington, Samuel (University of Glasgow)
Farah, Ilijas (York University)
Gabe, James (University of Glasgow)
Gardella, Eusebio (University of Muenster)
Gillaspy, Elizabeth (University of Montana)
Giordano, Thierry (University of Ottawa)
Gong, Guihua (University of Peurto Rico)
Ivanescu, Cristian (MacEwan University)
Jiang, Yongle (IMPAN)
Kalantar, Mehrdad (University of Houston)
Kennedy, Matthew (University of Waterloo)
Kerr, David (Texas A&M University)
Li, Xin (Queen Mary University of London)
Li, Hanfeng (SUNY at Buffalo)
Liao, Hung-Chang (University of Ottawa)
Lin, Huaxin (University of Oregon)
Nekrashevych, Volodymyr (Texas A & M University)
Niu, Zhuang (University of Wyoming)
Phillips, Christopher (University of Oregon)
Putnam, Ian (University of Victoria)
Renault, Jean (Universite d' Orleans)
Reznikoff, Sarah (Kansas State University)
Robert, Leonel (University of Louisiana at Lafayette)
Sato, Yasuhiko (Kyoto University)
Skau, Christian (Norwegian University of Science and Technology)
Starling, Charles (Carleton University)
Strung, Karen (Radboud University)
Suzuki, Yuhei (Nagoya University)
Szabo, Gabor (KU Leuven)
Thiel, Hannes (University of Münster)
Viola, Maria Grazia (Lakehead University)
White, Stuart (University of Glasgow)
Willett, Rufus (University of Hawaii at Mānoa)
Winter, Wilhelm (University of Muenster)
Wu, Jianchao (Texas A&M University)

Random Matrix Products and Anderson Localization
September 15 - 20, 2019

Organizers:

Anton Gorodetski (University of California Irvine) **David Damanik** (Rice University)

In condensed matter physics, Anderson localization is the absence of diffusion of waves in a random (disordered) medium. A popular, though not quite equivalent, mathematical justification of (spectral) Anderson localization is pure point spectrum of the corresponding Schrödinger operator with random potential, along with exponentially decaying eigenfunctions. While the strong relation between Anderson localization and properties of random matrix products is known, it is far from being completely understood. People working in these areas have quite different backgrounds, and in a sense “speak different languages”. The meeting brought together people from spectral theory, dynamical systems, and probability theory that work independently on closely related questions to exchange the ideas and facilitate the collaboration.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5086

Participants:

Baxendale, Peter (University of Southern California)
Damanik, David (Rice University)
Dorsch, Florian (University of Erlangen-Nuremberg)
Fillman, Jake (Texas State University)
Goldsheid, Ilya (Queen Mary, University of London)
Gordenko, Anna (University of Rennes 1)
Gorodetski, Anton (University of California Irvine)
Helman, Mark (Rice University)
Jun, Hyunkyu (Rice University)
Kesten, Jacob (Rice University)
Kleptsyn, Victor (CNRS)
Quintino, Fernando (University of California Irvine)
Rangamani, Nishant (University of California Irvine)
Smart, Charles (University of Chicago)
Sukhtaiev, Selim (Rice University)
Takahashi, Yuki (Tohoku University)
VandenBoom, Tom (Yale University)
Zhu, Xiaowen (University of California Irvine)

Emerging Statistical Challenges & Methods for Analysis of Human Microbiome Data
September 15 - 20, 2019

Organizers:

Yijuan Hu (Emory University)
Hong Gu (Dalhousie University)
Shyamal Peddada (University of Pittsburgh)
Michael Wu (Fred Hutchinson Cancer Research Center)

Studies on the human microbiome have revealed that differences in microbial communities is associated with many human disorders, such as Crohn's disease, type II diabetes, asthma, obesity, and even autism, Alzheimer's disease and some cancers. The microbiome is an attractive target for establishing new biomarkers for diagnosis, disease progression and prognosis, and for developing low-cost, low-risk, interventions. Given the potential effect of microorganisms on public health and precision medicine, it is imperative to elucidate the roles that different microbiota play in the maintenance of human health and in the development of diseases. To this end, novel statistical methods are sorely needed to translate the massive amount of newly generated microbiome data into scientific discovery. This workshop focussed on methods to address emerging challenges in the analysis of such data. It brought together international experts in this important field of research to advance our understanding of the methods and tools which can be effectively applied to address common issues that arise in the analysis of human microbiome data.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5221

Participants:

Beiko, Robert (Dalhousie University)
Fettweis, Jennifer (Virginia Commonwealth University)
Gloor, Gregory (University of Western Ontario)
Gu, Hong (Dalhousie University)
Hertzberg, Vicki (Emory University)
Huzurbazar, Snehalata (West Virginia University)
Kenney, Toby (Dalhousie University)
Knox, Natalie (Public Health Agency of Canada)
Lee, Myung Hee (Center for Global Health)
Li, Hongzhe (University of Pennsylvania)
Li, Huilin (New York University)
McMurdie, Paul (Pendulum Therapeutics)
Peddada, Shyamal (University of Pittsburgh)
Satten, Glen (Emory University)
Smirnova, Ekaterina (Virginia Commonwealth University)
Tang, Zhengzheng (University Wisconsin - Madison)
Wu, Michael (Fred Hutchinson Cancer Research Center)
Zhao, Ni (Johns Hopkins University)

New Challenges in Energy Markets - Data Analytics, Modelling and Numerics
September 22 - 27, 2019

Organizers:

Tony Ware (The University of Calgary)
Michael Coulon (The University of Sussex)
Carlos Vazquez Cendon (Universidade da Coruna)

This workshop brought together academics and industry practitioners from around the world working in related areas to focus on the new challenges that are arising from the rapid changes taking place in energy commodity and related environmental markets, including the explosive growth in the amount and variety of data that is becoming available. They discussed new ideas in data analytics, modelling and numerics that are being developed to meet these challenges. Energy markets have in recent years become fertile ground for the application of new mathematical techniques, but much work is still needed.

Therefore, a primary aim of the workshop was to seek to identify opportunities for cross fertilization of innovative and complementary ideas, stimulating interdisciplinary collaboration across academia and also with industry. On the one hand, we aimed to strengthen academic research agendas by targeting the most important problems currently faced by the energy sector. Simultaneously, we hoped to help better equip practitioners with the latest mathematical techniques and academic knowledge tailored to energy applications.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5229

Participants:

Alos, Elisa (University Pompeu Fabra)
Baamonde Seoane, Maria (Universidade da Coruña)
Baruch, Daniel (Ursa)
Byers, Joe (Oklahoma State University)
Calistrate, Dan (Direct Energy Marketing Ltd)
Calvo-Garrido, M. Carmen (Universidade da Coruña)
Cartea, Alvaro (University of Oxford)
Chan, Erik (University of Calgary)
Christara, Christina C. (University of Toronto)
Coskun, Sema (University of Kaiserslautern)
Cote, Philippe (University of Alberta)
Coulon, Michael (The University of Sussex)
Cummins, Mark (Dublin City University)
Davison, Matthew (University of Western Ontario)
Deschatre, Thomas (EDF)
Düring, Bertram (University of Sussex)
Ehrhardt, Matthias (University of Wuppertal)
Firoozi, Dena (University of Toronto)
Guasoni, Paolo (Dublin City University)
Hao, Kunlin (Capital Power Corporation)
In 't Hout, Karel (University of Antwerpen)
Kaminski, Vincent (Rice University)
Lange, Nina (Technical University of Denmark)
Li, Xiang (University of Calgary)
Lu, Weiliang (University of Calgary)
Mehranfar, Maedeh (Concordia University)
Moazeni, Somayeh (Stevens Institute of Technology)
Oosterlee, Cornelis (CWI Amsterdam and Delft University of Technology)
Pak, Yufi (University of Sussex Business School)
Pavlin, Michael (Wilfred Laurier University)
Safaian, Nima (Cenovus Energy)
Shrivats, Arvind (University of Toronto)
Sircar, Ronnie (Princeton University)
Sun, Zuming (University of Calgary)
Swindle, Glen (Scoville Risk Partners)
Swishchuk, Anatoliy (University of Calgary)
Wagner, Andreas (Fraunhofer Institute for Industrial Mathematics)
Ware, Tony (The University of Calgary)
Wei, Wenning (University of Calgary)

Classification Problems in von Neumann Algebras
September 29 - October 4, 2019

Organizers:

Adrian Ioana (University of California San Diego)

Jesse Peterson (Vanderbilt University)

Von Neumann algebras are certain collections of infinite matrices, which were originally introduced as a tool to understand quantum mechanics, and representation theory of groups. They arise naturally in various contexts, notably from groups and their actions on measure spaces. A fundamental problem is: how much structure does a von Neumann algebra remember about the group or group action it was constructed from? The workshop focussed on this and related classification problems. This is a very active and broad research program, which has deep and fruitful connections with other areas of mathematics, including ergodic theory, group theory, and logic. The workshop took advantage of these connections and capitalized on the spectacular breakthroughs made in the past few years to stimulate further progress and interaction.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5134

Participants:

Anantharaman-Delaroche, Claire (Universite d'Orleans)
Araiza, Roy (Purdue University)
Argerami, Martin (University of Regina)
Atkinson, Scott (University of California Riverside)
Bekka, Bachir (University of Rennes France)
Boutonnet, Remi (Universite de Bordeaux)
Charlesworth, Ian (UC Berkeley)
Chifan, Ionut (University of Iowa)
Courtney, Kristin (WWU Münster)
de Laat, Tim (Westfälische Wilhelms-Universität Münster)
de Santiago, Rolando (University of California Los Angeles)
Drimbe, Daniel (University of Regina)
Goldbring, Isaac (University of California, Irvine)
Hayes, Ben (University of Virginia)
Hoff, Daniel (University of California Los Angeles)
Ioana, Adrian (University of California San Diego)
Isono, Yusuke (Kyoto University)
Jekel, David (UCLA)
Junge, Marius (University of Illinois at Urbana-Champaign)
Juschenko, Kate (University of Texas at Austin)
Kida, Yoshikata (University of Tokyo)
Kunnawalkam Elayavalli, Srivatsav (Vanderbilt University)
Le Maitre, Francois (Université Paris Diderot)
Marks, Andrew (University of California Los Angeles)
Nelson, Brent (Michigan State University)
Peterson, Jesse (Vanderbilt University)
Raum, Sven (Stockholm University)
Ruth, Lauren (University of Vanderbilt)
Sherman, David (University of Virginia)
Sinclair, Thomas (Purdue)
Spaas, Pieter (University of California San Diego)
Suzuki, Yuhei (Nagoya University)
Tucker-Drob, Robin (Texas A&M University)
Ueda, Yoshimichi (Nagoya University)
Vaes, Stefaan (KU Leuven)
Valette, Alain (Universite de Neuchatel)
Weeks, John (Texas AM University)

Herglotz-Nevanlinna Theory Applied to Passive, Causal and Active Systems October 6 - 11, 2019

Organizers:

Aaron Welters (Florida Institute of Technology - Melbourne)
Andrea Alu (City University of New York)
Mats Gustafsson (Lund University)
Annemarie Luger (Stockholm University)

There are not so many instances where mathematicians, who are interested in theory and applications, and electrical engineers working towards developing applications, who recognized the power of mathematics, are actually meeting. It was the purpose of the workshop to bring together representatives from these groups. Toward this goal the workshop organizers included two electrical engineers and three mathematicians. With joint forces it is possible to treat new applications of old and well understood (mathematical) objects as well as advancing the classical study of them. Recent advances in electrical engineering have shown that mathematical tools from functional theory can be brought to bear on finding fundamental limits on the performance of metamaterials and composites, generally, as well as defining limitations to broadband cloaking. It is also hoped that the results of this workshop would ultimately improve imaging methods. This is of obvious importance to medical imaging, geophysical prospecting, and homeland security.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5209

Participants:

Alpay, Daniel (Chapman University)
Ball, Joseph (Virginia Tech)
Caloz, Christophe (École Polytechnique of Montréal)
Cassier, Maxence (Aix-Marseille University)
Cherkaev, Elena (University of Utah)
Engstrom, Christian (Linneaus University)
Figotin, Alexander (University of California at Irvine)
Frymark, Dale (Stockholm University)
Gesztesy, Fritz (Baylor University)
Golden, Kenneth (University of Utah)
Grabovsky, Yury (Temple University)
Gralak, Boris (Institut Fresnel)
Guevara Vasquez, Fernando (University of Utah)
Gustafsson, Mats (Lund University)
Hovsepyan, Narek (Temple University)
Ivanenko, Yevhen (Linnaeus University)
Joly, Patrick (Institut National de Recherche et In formatique et Automatique)
Jonsson, Lars (KTH Royal Institute of Technology)
Kern, Christian (University of Utah)
Luger, Annemarie (Stockholm University)
Mattei, Ornella (University of Utah)
Miller, Owen (Yale University)
Milton, Graeme (University of Utah)
Monticone, Francesco (Cornell University)
Nedic, Mitja (Stockholm University)
Nordebo, Sven (Linnaeus University)
Onofrei, Daniel (University of Houston)
Ou, M. Yvonne (University of Delaware)
Putinar, Mihai (University of California - Santa Barbara)
Schab, Kurt (Santa Clara University)
Sjoberg, Daniel (Lund University)
Vandenbosch, Guy (KU Leuven)
Vinnikov, Victor (Ben Gurion University of the Negev)
Wellander, Niklas (Swedish Defence Research Agency, FOI)
Welters, Aaron (Florida Institute of Technology - Melbourne)
Withanachchi, Mahishanka (Laval University)
Yaghjian, Arthur (Electromagnetics Research Consultant)

Physics-Dynamics Coupling in Earth System Models
October 13 - 18, 2019

Organizers:

Nicholas Kevlahan (McMaster University)

Peter Lauritzen (National Center for Atmospheric Research)

The mathematics of climate change is one of the grand challenges of 21st century. Atmospheric phenomena range from large scale monsoons and jet stream meanders with spatial scales of thousands of km's and time-scales of months to years all the way down to individual cumulus clouds formed by turbulence with spatial scales of 100 meters and time-scales of minutes.

This workshop helped develop the mathematics necessary to advance our understanding of how to efficiently and accurately link these physical processes. Improvements in this "physics-dynamics" coupling is the major obstacle to improved accuracy of climate models.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5153

Participants:

Adcroft, Alistair (Princeton University)
Donahue, Aaron (Lawrence Livermore National Laboratory)
Dubos, Thomas (École Polytechnique)
Eldred, Chris (INRIA - Université de Grenoble Alpes)
Gassmann, Almut (Leibniz-Institut fur Atmospharen physik)
Harrop, Bryce (Pacific Northwest National Laboratory)
Herrington, Adam (Stony Brook University)
Jablonowski, Christiane (University of Michigan)
Johansen, Hans (Lawrence Berkeley National Lab)
Kevlahan, Nicholas (McMaster University)
Large, William (National Center for Atmospheric Research)
Larson, Vince (University of Wisconsin Milwaukee)
Lauritzen, Peter (National Center for Atmospheric Research)
Lemarié, Florian (Inria - Univ. Grenoble Alpes)
Randall, David (Colorado State University)
Rasch, Philip (Pacific Northwest National Laboratory)
Roy, Kumar (Indian Institute of Tropical Meteorology)
Shipway, Ben (Met Office)
Tailleux, Remi (University of Reading)
Wan, Hui (Pacific Northwest National Laboratory)

Spaces of Embeddings: Connections and Applications
October 13 - 18, 2019

Organizers:

Dev Sinha (University of Oregon)
Ryan Budney (University of Victoria)
Robin Koytcheff (University of Louisiana at Lafayette)
Ismar Volic (Wellesley College)

Imagine a vibrating string. In mathematics, we would call this a one-dimensional motion (the dimension being the time over which the vibration occurs) of a one-dimensional object (the string) in three dimensions (our spatial universe). Mathematicians are interested in much more general music, where the object, the place in which it is vibrating and even the "time" over which it vibrates can all have many dimensions. Understanding the structure of such objects, which mathematicians call "spaces of embeddings", is a basic question in the field of topology. Like much rich mathematics, it connects with many other areas in mathematics and beyond. These include the study of all possible ways to combine objects (operads), the study of quantities which can be defined through breaking things apart (topological field theories), and more elementary (but not easy!) subjects including graph theory and knot theory.

In this workshop, we brought together researchers in all of these areas, who constitute a diverse collection of mathematicians (by time in career, gender, and nationality) to contemplate vibrating strings and their impact throughout mathematics and beyond.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5232

Participants:

Bauer, Kristine (University of Calgary)
Boavida de Brito, Pedro (Universidade de Lisboa)
Budney, Ryan (University of Victoria)
Goodwillie, Tom (Brown University)
Horel, Geoffroy (Université Paris 13)
Knudsen, Benjamin (Northeastern University)
Kosanovic, Danica (Max Planck Institute for Mathematics)
Koytcheff, Robin (University of Louisiana at Lafayette)
Kupers, Alexander (Harvard University)
Lambrechts, Pascal (Universite de Louvain)
Lescop, Christine (Université Grenoble Alpes)
Mortier, Arnaud (University of Caen Normandy)
Nakade, Apurva (University of Western Ontario)
Pelatt, Kristine (St. Catherine University)
Polyak, Michael (Technion)
Sakai, Keiichi (Shinshu University)
Salvatore, Paolo (Univ. of Rome Tor Vergata)
Sinha, Dev (University of Oregon)
Stanley, Donald (University of Regina)
Turchin, Victor (Kansas State University)

Women in Commutative Algebra
October 20 - 25, 2019

Organizers:

Emily Witt (University of Kansas)
Karen Smith (University of Michigan)
Sandra Spiroff (University of Mississippi)
Irena Swanson (Reed College)

Women in Commutative Algebra (WICA) is a five-day workshop focused on research collaboration in small groups. The women algebraists, ranging from early-career mathematicians to leaders in the field, conducted research on cutting edge topics in commutative algebra. The workshop made advances in commutative algebra through state-of-the-art research and promoted the research of women in commutative algebra.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5104

Participants:

Berkesch, Christine (University of Minnesota)
Celikbas, Ela (West Virginia University)
Chan, C-Y. Jean (Central Michigan University)
Cooper, Susan (University of Manitoba)
Dufresne, Emilie (University of York)
El Khoury, Sabine (American University of Beirut)
Faber, Eleonore (University of Leeds)
Faridi, Sara (Dalhousie University)
Fouli, Louiza (New Mexico State University)
Gandini, Francesca (Kalamazoo College)
Gorla, Elisa (University of Neuchatel)
Grifo, Eloísa (University of California Riverside)
Hering, Milena (Edinburgh University)
Juhnke-Kubitzke, Martina (University of Osnabrück)
Kadyrsizova, Zhibek (Nazarbayev University)
Kenkel, Jennifer (University of Kentucky)
Klein, Patricia (University of Kentucky)
Lin, Kuei-Nuan (Penn State Greater Allegheny)
Lindo, Haydee (Williams College)
Maclagan, Diane (University of Warwick)
Matusevich, Laura (Texas A&M University)
Mayes-Tang, Sarah (University of Toronto)
Miller, Claudia (Syracuse University)
Mohammadi, Fatemeh (University of Bristol)
Morey, Susan (Texas State University)
Page, Janet (University of Michigan)
Polini, Claudia (University of Notre Dame)
R.G., Rebecca (George Mason University)
Rajchgot, Jenna (University of Saskatchewan)
Seceleanu, Alexandra (University of Nebraska Lincoln)
Sega, Liana (University of Missouri)
Singh, Jyoti (Visvesvaraya National Institute of Technology - Nagpur)
Smith, Karen (University of Michigan)
Spiroff, Sandra (University of Mississippi)
Striuli, Janet (National Science Foundation)
Swanson, Irena (Reed College)
Vassilev, Janet (University of New Mexico)
Vraciu, Adela (University of South Carolina)
Wheeler, Ashley (Mount Holyoke College)
Witt, Emily (University of Kansas)
Yu, Josephine (Georgia Institute of Technology)

Bridging the Gap between Kahler and non-Kahler Complex Geometry
October 27 - November 1, 2019

Organizers:

Dan Popovici (Universite Paul Sabatier)
Vestislav Apostolov (Université du Québec à Montréal)
Anna Fino (Universita di Torino)
Duong H. Phong (Columbia University)

Our workshop brought together mathematicians working in complex analytic, differential and algebraic geometry, as well as geometric PDEs, complex analysis and topology, in an attempt to make progress towards a unified classification theory of compact complex, not necessarily algebraic or even Kähler, manifolds. This is a major endeavour in modern mathematics.

We focused on two types of structures that these manifolds may support: metric structures (ways of measuring distances on these manifolds) and cohomological structures (pertaining to topological properties of the complex structure of these manifolds). Very few manifolds admit a type of metrics, called Kähler, that have many symmetries and imply cohomological properties, but most of them do not. However, large classes of manifolds support weaker types of special metrics that imply cohomological and geometric properties similar to their Kähler counterparts.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5051

Participants:

Albanese, Michael (UQAM)
Angella, Daniele (Università degli Studi di Firenze)
Apostolov, Vestislav (Université du Québec à Montréal)
Bismut, Jean-Michel (Université Paris-Sud)
Blocki, Zbigniew (Jagiellonian University)
Buchdahl, Nicholas (University of Adelaide)
Cirici, Joana (Universitat de Barcelona)
Collins, Tristan (Massachusetts Institute of Technology)
Dinew, Slawomir (Jagiellonian University)
Dloussky, Georges (Aix-Marseille University)
Fei, Teng (Columbia University)
Fino, Anna (Universita di Torino)
Garcia-Fernandez, Mario (Universidad Autonoma de Madrid)
Gauduchon, Paul (Centre National de la Recherche Scientifique)
Grantcharov, Gueo (Florida International University)
Haslinger, Friedrich (University of Vienna)
Kolodziej, Slawomir (Jagiellonian University)
Lejmi, Mehdi (City University of New York)
Margerin, Christophe (Ecole Polytechnique)
Moraru, Ruxandra (University of Waterloo)
Moroianu, Andrei (CNRS)
Otiman, Alexandra (Università Roma Tre)
Phong, Duong H. (Columbia University)
Picard, Sebastien (Harvard University)
Pontecorvo, Massimiliano (Università Degli Studi Roma Tre)
Popovici, Dan (Universite Paul Sabatier)
Rasdeaconu, Rares (Vanderbilt University)
Rollenske, Soenke (University of Marburg)
Salvatore, Francesca (Università di Torino, Italy)
Shen, Xi Sisi (Northwestern University)
Stelzig, Jonas (Ludwig Maximilian University)
Streets, Jeff (University of California Irvine)
Tardini, Nicoleta (University of Florence)
Tosatti, Valentino (Northwestern University)
Verbitsky, Misha (IMPA)
Vezzoni, Luigi (University of Torino)
Weinkove, Ben (Northwestern University)
Wilson, Scott (Queens College, CUNY)
Zhang, Xiangwen (University of California Irvine)

Unifying 4-Dimensional Knot Theory
November 3 - 8, 2019

Organizers:

Jeffrey Meier (Western Washington University)
Scott Carter (University of South Alabama)
Alex Zupan (University of Nebraska-Lincoln)

Knot theory is the study of knotted loops in 3--dimensional space, considered up to smooth deformations which do not break the loop. Advances in knot theory have informed our collective understanding of a diverse range of topics, from the chemical reactions that can take place when replicating DNA becomes knotted, to physical properties of different conformations of knotted molecules. Knot theory also has deep connections to high energy physics. Although we live in 3--dimensional space, the evolution of a 3--dimensional object over time is inherently a 4--dimensional structure, since including time involves an extra degree of freedom. Thus, studying 3--dimensional and 4--dimensional spaces are integrally related to the world in which we live.

This workshop developed a better understanding of knotting in dimension four. In this realm, loops can never be knotted -- there is simply too much “room” in which to perform a smooth deformation. Instead, the interesting knotted objects are surfaces.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5118

Participants:

Auckly, David (Kansas State University)
Bar-Natan, Dror (University of Toronto)
Baykur, Inanc (University of Massachusetts)
Boden, Hans (McMaster University)
Budney, Ryan (University of Victoria)
Carter, Scott (University of South Alabama)
Damiani, Celeste (University of Leeds)
Dancso, Zsusanna (University of Sydney)
Gabai, David (Princeton University)
Gaudreau, Robin (University of Toronto)
Gompf, Bob (University of Texas Austin)
Gordon, Cameron (University of Texas at Austin)
Hillman, Jonathan (University of Sydney)
Hughes, Mark (Brigham Young University)
Inoue, Ayumu (Tsuda University)
Islambouli, Gabriel (University of Waterloo)
Joseph, Jason (University of Georgia)
Kim, Byeorhi (Kyungpook National University)
Kim, Hee Jung (Seoul National University)
Kim, Seungwon (Institute for Basic Science)
Kirby, Rob (University of California-Berkeley)
Kjuchukova, Alexandra (Max Plank Institute for Mathematics)
Longo, Vincent (Univeristy of Nebraska)
Mark, Thomas (University of Virginia)
McDonald, Clayton (Boston College)
Meier, Jeffrey (Western Washington University)
Miller, Maggie (Princeton University)
Moeller, Jesse (University of Nebraska-Lincoln)
Naylor, Patrick (University of Waterloo)
Oshiro (Shoda), Kanako (Sophia University)
Penney, Mark (University of Waterloo)
Ray, Arunima (Max Plank Institute for Mathematics)
Ruberman, Daniel (Brandeis University)
Saito, Masahico (University of South Florida)
Satoh, Shin (Kobe University)
Schwartz, Hannah (Bryn Mawr College)
Starkston, Laura (University of California-Davis)
Sunukjian, Nathan (Calvin College)
Thompson, Abigail (University of California, Davis)
Williams, Marla (University of Nebraska-Lincoln)
Zupan, Alex (University of Nebraska-Lincoln)

Interactions between Brauer Groups, Derived Categories and Birational Geometry of Projective Varieties
November 10 - 15, 2019

Organizers:

Nathan Grieve (Michigan State University)

Colin Ingalls (Carleton University)

There are deep interrelations between ideas from non-commutative algebra, geometry and Mathematical Physics. Some of these interconnections are revealed through the study of Brauer groups of function fields, bounded derived categories of coherent sheaves on projective varieties and Mori's minimal model program. The mathematically rigorous interactions between these topics provide some motivation for the proposed workshop Interactions between Brauer Groups, Derived Categories and Birational Geometry of Projective Varieties. Some underlying themes are questions which pertain to rationality of algebraic varieties. In particular, the concepts of rational, unirational and stably rational varieties. As one outcome, this workshop facilitated interdisciplinary research collaborations amongst researchers with expertise in the subjects of Brauer groups, derived categories and birational geometry.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5164

Participants:

Ballard, Matthew (University of South Carolina)
Belmans, Pieter (University of Bonn)
Bragg, Daniel (University of California Berkeley)
Chidambaram, Nitin Kumar (University of Alberta)
Chinen, Minako (University of Alberta)
Dhillon, Ajneet (University of Western Ontario)
Diaz, Humberto (Washington University St Louis)
Doran, Charles (University of Alberta)
Duncan, Alexander (University of South Carolina)
Eckl, Thomas (University of Liverpool)
Favero, David (University of Alberta)
Frei, Sarah (Rice University)
Gille, Stefan (University of Alberta)
Grieve, Nathan (Michigan State University)
Gulbrandsen, Martin (University of Stavanger)
Ingalls, Colin (Carleton University)
Jabbusch, Kelly (University of Michigan - Dearborn)
Katzarkov, Ludmil (University of Miami)
Kulkarni, Rajesh (Michigan State University)
Lamarche, Alicia (University of South Carolina)
Lee, Sangwook (KIAS)
Lemire, Nicole (University of Western Ontario)
Lesieutre, John (The Pennsylvania State University)
Lewis, James (University of Alberta)
Lieblich, Max (University of Washington)
Lombardi, Luigi (University of Milan)
Mackall, Eoin (University of Alberta)
McFaddin, Patrick (Fordham University)
Parimala, Raman (Emory University)
Saltman, David J (Center for Communications Research - Princeton)
Scully, Stephen (University of Victoria)
Tasin, Luca (University of Bonn)
Topaz, Adam (University of Alberta)
You, Fenglong (University of Alberta)
Zainoulline, Kirill (University of Ottawa)

Dimers, Ising Model, and their Interactions
November 17 - 22, 2019

Organizers:

Gourab Ray (University of Victoria)
Julien Dubedat (Columbia University)
Hugo Duminil-Copin (Institut des Hautes Études Scientifiques)

Statistical physics models on graphs have been one of the most exciting area of research in probability theory over the past few decades. In this workshop we focused on a particularly popular model called the dimer model and its connections with other statistical physics models, especially the Ising model. The dimer model can be simply defined as a model of perfect matching, and it is well-established that this model stands at an interface of geometry, combinatorics, algebra and analysis. The Ising model is perhaps one of the most classical models of statistical physics and it can be used to describe the behaviour of a magnet at various temperatures. Deep and fascinating mathematics describe the behaviour of these two models and their interconnections. With all the recent exciting developments many longstanding open problems (such as the convergence of double dimer interfaces) seem within reach.

The goal of this workshop was to bring together researchers with expertise in various aspects of this field so that we can have a better understanding of the interplay between these various branches of mathematics, which forms the core of this subject of research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5062

Participants:

Aggarwal, Amol (Harvard)
Aizenman, Michael (Princeton University)
Angel, Omer (University of British Columbia)
Berestycki, Nathanael (University of Vienna)
Boutillier, Cédric (Sorbonne Université)
Budzinski, Thomas (University of British Columbia)
Chandgotia, Nishant (Hebrew university of Jerusalem)
Chelkak, Dmitry (ENS-Mitsubishi Heavy Industries)
Chhita, Sunil (Durham University)
Dauvergne, Duncan (Princeton University)
De Tiliere, Béatrice (University Paris Dauphine)
Dubedat, Julien (Columbia University)
Duminil-Copin, Hugo (Institut des Hautes Études Scientifiques (IHÉS))
Ferrari, Patrik (University of Bonn)
Giuliani, Alessandro (Università degli Studi Roma Tre)
Glazman, Alexander (Tel Aviv University)
Gorin, Vadim (MIT)
Greenblatt, Rafael (Università Roma Tre)
Harel, Matan (Tel Aviv University)
Johansson, Kurt (KTH Royal Institute of Technology)
Kenyon, Richard (Brown University)
Lammers, Piet (University of Cambridge)
Laslier, Benoit (University Paris-Diderot)
Li, Zhongyang (University of Connecticut)
Lis, Marcin (University of Vienna)
Manolescu, Ioan (Université de Fribourg)
Melotti, Paul (Sorbonne Université)
Musiker, Gregg (University of Minnesota)
Petrov, Leonid (University of Virginia)
Powell, Ellen (ETH Zurich)
Ramassamy, Sanjay (CNRS / CEA Saclay)
Ray, Gourab (University of Victoria)
Russkikh, Marianna (Massachusetts Institute of Technology)
Sheffield, Scott (Massachusetts Institute of Technology)
Spinka, Yinon (University of British Columbia)
Tassy, Martin (Dartmouth College)
Young, Benjamin (University of Oregon)

Theoretical Foundations of Relativistic Hydrodynamics
November 24 - 29, 2019

Organizers:

Michal P. Heller (Max Planck Institute for Gravitational Physics)
Ulrich Heinz (Ohio State University)
Guy Moore (Technische Universitat Darmstadt)

How small can a droplet be and still behave as a fluid? The latest research unexpectedly suggests that droplets of the size of a fraction of an atomic nucleus made from quark-gluon plasma, an exotic type of matter of extreme energy density, have liquid-like properties. Quark-gluon plasma once filled the entire universe and can today be recreated in high-energy collisions between atomic nuclei. This timely workshop brought together a multi-disciplinary group of researchers to rethink the foundations behind our contemporary understanding of ultra-hot and fast-moving fluids.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5048

Participants:

Brewer, Jasmine (MIT)
Flörchinger, Stefan (Heidelberg University)
Florkowski, Wojciech (Jagiellonian University)
Grozdanov, Saso (MIT)
Heinz, Ulrich (Ohio State University)
Heller, Michal P. (Max Planck Institute for Gravitational Physics)
Jaiswal, Amaresh (National Institute of Science Education and Research Bhubaneswar - India)
Knaute, Johannes (Max Planck Institute for Gravitational Physics (Albert Einstein Institute))
Kovtun, Pavel (University of Victoria)
Mateos, David (ICREA & U Barcelona)
Mazeliauskas, Aleksas (Heidelberg University/CERN)
Noronha, Jorge (Instituto de Física - USP)
Noronha-Hostler, Jacquelyn (Rutgers University)
R, Loganayagam (International Center for Theoretical Sciences, Bangalore)
Ryblewski, Radoslaw (Institute of Nuclear Physics Polish Academy of Sciences)
Serantes, Alexandre (National Centre for Nuclear Research - Poland)
Spalinski, Michal (National Centre for Nuclear Research)
Strickland, Michael (Kent State University)
Svensson, Viktor (MAX-PLANCK)
van der Schee, Wilke (CERN)
Yarom, Amos (Technion)

Challenges in Mathematical and Computational Modeling of Complex Systems
December 1 - 6, 2019

Organizers:

Christina Mair (University of Pittsburgh)
Paul Gruenewald (Prevention Research Center, Pacific Institute for Research and Evaluation)
Anuj Mubayi (Arizona State University)
Lance A. Waller (Emory University)

Substance use disorders remain a top public health problem, with approximately 16 million adults in the United States having an alcohol use disorder (AUD). According to CDC 2016 data, deaths from drug overdoses have doubled in last decade, with more than 60,000 deaths every year. We brought together substance use modeling experts to identify critical challenges in its control and jointly develop the next wave of models that can properly address the complex dynamics inherent in its social systems. These models examined phenomena at multiple scales to address the emergence of collective behaviors that arise from individual elements or parts of a system working together. Unlike biomedical and engineering problems, social systems present unique challenges. These include the need to assess impacts of policies, the long time scales often involved, the interdisciplinary nature of tackling these problems, the complexity of developing reliable models of human behavior, and the great difficulty of experimental testing. Successful change in social systems requires the active participation of a wide range of people in the modeling and policy design process. As applied to substance use, computational and mathematical models serve two essential purposes in efforts to reduce alcohol drinking, illicit drugs use and related problems within community environments.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5218

Participants:

Arunachalam, Viswanathan (Universidad Nacional de Colombia)
Banerjee, Malay (Indian Institute of Technology Kanpur)
Cerda, Magdalena (NYU School of Medicine)
Churchill, Sam (University of Victoria)
Coulter, Robert (University of Pittsburgh)
Galloway, David (University of Pittsburgh)
Goldstick, Jason (University of Michigan)
Gorman, Dennis (Texas A&M University)
Grilo, Luís Miguel (Instituto Politécnico de Tomar)
Hallgren, Kevin (University of Washington)
Hitsman, Brian (Northwestern University)
Jay, Jonathan (Boston University)
Kline, David (Ohio State University)
Krauland, Mary (University of Pittsburgh)
Lee, Taejin (Augusta University)
Liu, Xin (Clemson University)
Mair, Christina (University of Pittsburgh Graduate School of Public Health)
Marshall, Brandon (Brown University)
Meier, Petra (University of Sheffield)
Mooney, Stephen (University of Washington)
Morrison, Christopher (Columbia University)
Mubayi, Anuj (Arizona State University)
Nelson, Toben (University of Minnesota)
Popovici, Irina (US Naval Academy)
Purshouse, Robin (University of Sheffield)
Rao, Arni S.R. Srinivasa (Medical College of Georgia)

Discrete Subgroups of Lie Groups
December 8 - 13, 2019

Organizers:

Dave Morris (University of Lethbridge)
Michael Kapovich (University of California at Davis)
Gregory Margulis (Yale University)
Gregory Soifer (Bar-Ilan University)

Group theory is the mathematical study of objects that have a symmetric or repeating structure. The workshop brought together researchers who have a variety of approaches to the investigation of "thin" groups, which are groups of a particular type that are not yet well understood, but have important connections to other fields of mathematics, including arithmetic, geometry, algebra, and dynamical systems (the mathematical study of motion). Lectures and work in small groups were organized to forge new connections between the different points of view, and make progress on fundamental open questions.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5040

Participants:

Choi, Suhyoung (Korea Advanced Institute of Science and Technology)
Danciger, Jeffrey (University of Texas - Austin)
Detinko, Alla (University of Hull)
Drutu, Cornelia (Oxford University)
Felikson, Anna (University of Durham)
Flannery, Dane (National University of Ireland, Galway)
Gekhtman, Ilya (University of Toronto)
Kapovich, Michael (University of California at Davis)
Kleinbock, Dmitry (Brandeis University)
Kontorovich, Alex (Rutgers University)
Lee, Gye-Seon (Sungkyunkwan University)
Levit, Arie (Yale University)
Lipnowski, Michael (McGill University)
Liu, Beibei (University of California - Davis)
Maloni, Sara (University of Virginia)
Martone, Giuseppe (University of Michigan)
Meiri, Chen (Technion)
Morris, Dave (University of Lethbridge)
Murillo, Plinio G. P. (Korea Institute for Advanced Study)
Pham, Lam (Brandeis University)
Porti, Joan (Universitat Autonoma de Barcelona)
Radhika, M. M. (Tata Institute of Fundamental Research - India)
Rapinchuk, Andrei (University of Virginia)
Rapinchuk, Igor (Michigan State University)
Soifer, Gregory (Bar-Ilan University)
Stecker, Florian (University of Texas)
Tholozan, Nicolas (Ecole Normale Supérieure)
Tsouvalas, Konstantinos (University of Michigan)
Zhang, Tengren (National University of Singapore)
Zimmer, Andrew (Louisiana State University)

Banff International Research Station

2019

2-Day Workshops

First Year Mathematics Repository Workshop
February 8 - 10, 2019

Organizers:

Veselin Jungic (Simon Fraser University)

Miroslav Lovric (McMaster University)

This workshop represented the crucial step in further promotion and development of The First Year Mathematics Courses Repository, a resource supporting an ongoing national dialogue about teaching first year mathematics at Canadian universities. This shareable dynamic online database contains extensive data collected from mathematics instructors across the country. Data includes course content, resource and technology used, learning outcomes, modes of delivery, connections with other courses, as well as informal descriptions of various practices in teaching these courses

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2256

Participants:

Barr, Darja (University of Manitoba)
Bouchard, Vincent (University of Alberta)
Burazin, Andrijana (University of Toronto)
Chibry, Nancy (University of Calgary)
Coles, Matthew (University of British Columbia)
Davidson, Michelle (University of Manitoba)
de Vries, Gerda (University of Alberta)
DeDieu, Lauren (University of Calgary)
Desaulniers, Shawn (University of Alberta)
Forrest, Barbara (University of Waterloo)
Forrest, Brian (University of Waterloo)
Garaschuk, Kseniya (University of the Fraser Valley)
Gutierrez Funderburk, Laura (SFU)
Holden, Tyler (University of Toronto)
Jungic, Veselin (Simon Fraser University)
Lagu, Indy (Mount Royal University)
Leung, Fok-Shuen (University of British Columbia)
Lovric, Miroslav (McMaster University)
Maidorn, Patrick (University of Regina)
Malloch, Amanda (University of Victoria)
Pyke, Randall (Simon Fraser University)
Taylor, Peter (Queen's University)
Tichon, Jenna (University of Manitoba)
Tiede, Sasha (Simon Fraser University)

Precise computation of quantum amplitudes
April 5 - 7, 2019

Organizers:

Andrzej Czarnecki (University of Alberta)

This workshop prepared tools for theoretical predictions important for guiding and interpreting precise experiments. These experiments search for so-called New Physics, that is for phenomena beyond the currently known subatomic models. They are performed primarily in the United States (for example Mu2e at Fermilab) and in Japan (COMET at J-PARC). The subatomic theory group at the University of Alberta is a world leader in providing such precise predictions for experiments involving bound elementary particles.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2241

Participants:

Aslam, Muhammad Jamil (University of Alberta)

Czarnecki, Andrzej (University of Alberta)

Tissue Constitutive Models in Human Body Models for Enhanced Safety
April 12 -14, 2019

Organizers:

Duane Cronin (University of Waterloo)
John Combest (Nissan, Global Human Body Models Consortium)
Matthew Panzer (University of Virginia)
Ciaran Simms (Trinity College Dublin)

Accidental injury is a leading cause of reduced quality of life, hospitalization and fatality globally. The World Health Organization estimates 1.2 million fatalities and up to 50 million injuries per year associated with road traffic accidents. Crash Induced Injuries are recognized as preventable and Transport Canada has committed to reducing the number of road traffic fatalities. The US National Highway Traffic Safety Administration (NHTSA) has identified the importance of computer models and Human Body Models (HBM) capable of predicting injury as a vital biomechanics priority to improve safety. The primary inputs to a detailed finite element human model include geometry, boundary conditions and material properties.

This workshop brought together world experts from academia and industry, dedicated to the development, validation and application of human body models, to address a critical need for improved biological tissue mathematical models, required for widespread use of these models to improve human safety in transportation.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2266

Participants:

Adanty, Kevin (University of Alberta)
Al-Salehi, Loay (University of British Columbia)
Barker, Jeffrey (University of Waterloo)
Combest, John (Nissan, Global Human Body Models Consortium)
Corrales, Miguel A. (University of Waterloo)
Cripton, Peter (University of British Columbia)
Cronin, Duane (University of Waterloo)
Davis, Matthew (Elemance)
Decker, William (Wake Forest University)
Dennison, Christopher (University of Alberta)
Fonseca, Graham (UBC)
Forman, Jason (University of Virginia)
Gierczycka, Donata (University of Waterloo)
Iraeus, Johan (Chalmers University of Technology)
Khor, Fiona (University of Waterloo)
Klug, Corina (Graz University of Technology)
Lin, Chin-Hsu (General Motors)
Malcolm, Skye (Honda R&D Americas)
Masouros, Spyros (Imperial College London)
Panzer, Matthew (University of Virginia)
Romani, Sarah (University of British Columbia)
Rycman, Aleksander (University of Waterloo)
Singh, Dilaver (University of Waterloo)
Spicka, Jan (University of West Bohemia)

Ted Lewis SNAP Math Fair Workshop
April 26 - 28, 2019

Organizers:

Sean Graves (University of Alberta)

Trevor Pasanen (University of Alberta)

During this pivotal time of K-9 curriculum reform in our province it is important to find the correct balance between inquiry-based problem solving and practicing basic facts in the mathematics classroom. The purpose of a SNAP math fair is to provide a meaningful problem-solving experience for all students.

The workshop is extremely popular with teachers in elementary and secondary schools, provides them with resources for lesson plans, and it is helping to to reshape the way mathematics is being approached in the schools. Problem solving and puzzles in the classroom is now a specific area of the K-9 curriculum and in-service teachers have had very little training in using these tools effectively. This is not limited to Alberta schools, and the SNAP math fair idea is now spreading around the world. This type of 2-day workshop is considered front line approach in the collaborative effort between mathematicians, more experienced teachers, and all teachers interested in professional development to improve the mathematics teaching in the elementary level and beyond. To have teachers share their valuable experiences with math fair in their own schools is the best and most useful information to others.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2267

Participants:

Bowling, Suzanne (Edmonton Public Schools)
Desaulniers, Shawn (University of Alberta)
Farquharson, Keenan (University of Alberta)
Francis, Krista (University of Calgary)
Gold Bennett, Ayanna (University of Alberta)
Graves, Sean (University of Alberta)
Hoffman, Janice (Edmonton Public Schools)
Hohn, Tiina (MacEwan University)
Jones, Carolyn (Centre for Education)
Khan, Steven (University of Alberta)
Kinasevich, Robin (Edmonton Public School Board)
Lewis, Ted (SNAP Mathematics Foundation)
Lorway, Geri (Thinking 101/University of Alberta)
Omar, Maria (SHiNEdmonton)
Trevor, Pasanen (SNAP Mathematics Foundation)
Wi, Dami (University of Alberta (student))
Wong, Catherine (Edmonton Public Schools)
Worthington, Trent (Sir George Simpson School)

Alberta Number Theory Days XI (ANTD XI)
May 10 -12, 2019

Organizers:

Lee Troupe (University of Lethbridge)
Dang Khoa Nguyen (University of Calgary)
Wolfgang Riedler (University of Alberta)
Peng-Jie Wong (University of Lethbridge)

Number theory is a broad and central area of research with many connections and applications to other areas of mathematics and science. It is also an extremely active and diverse area of research. In recent years there have been significant advances in both analytic and algebraic number theory. The annual Alberta Number Theory Days provided a unique venue for these researchers, their students, and their visitors for face to face discussion of ideas and for facilitating collaborations. New connections are made and old associations are renewed.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2262

Participants:

Akbary, Amir (University of Lethbridge)
Aygin, Zafer Selcuk (University of Lethbridge)
Chidambaram, Nitin Kumar (University of Alberta)
Cunningham, Clifton (University of Calgary)
Das, Sourabh (University of Lethbridge)
Feaver, Amy (The King's University)
Fiori, Andrew (University of Lethbridge)
Gordon, Julia (University of British Columbia)
Greenberg, Matthew (University of Calgary)
Gunn, Keira (University of Calgary)
Guy, Richard (The University of Calgary)
Hamieh, Alia (University of Northern British Columbia)
Jacobson, Michael (University of Calgary)
Juul, Jamie (University of British Columbia)
Kadiri, Habiba (University of Lethbridge)
Klys, Jack (University of Calgary)
Koziol, Karol (University of Alberta)
Leem, Sumin (University of Calgary)
Ng, Nathan (University of Lethbridge)
Nguyen, Dang Khoa (University of Calgary)
Patnaik, Manish (University of Alberta)
Riedler, Wolfgang (University of Alberta)
Roettger, Eric (Mount Royal University)
Scheidler, Renate (University of Calgary)
Shen, Quanli (University of Lethbridge)
Topaz, Adam (University of Alberta)
Tran, Nguyen Thanh Ha (Concordia University)
Troupe, Lee (University of Lethbridge)
Webster, Jonathan (University of Calgary (visiting))
Wong, Peng-Jie (University of Lethbridge)
Wong, Tian An (University of British Columbia)

Innovations in New Instructor Training
June 21 - 23, 2019

Organizers:

Gordon Huang (University of Regina)

Zhong Li (McMaster University)

Teaching is a crucial part of an academic mathematician's career. Nevertheless, instructor training programs for mathematicians, especially early career graduate students and postdoctoral fellows, vary widely. This workshop brought together key players in Mathematics departments across North America to share successful practices and to address ever-increasing instructional demands.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2231

Participants:

Barnes, Julie (Western Carolina University)
Bauer, Mark (University of Calgary)
Blois, Cindy (University of Toronto)
Bruni, Carmen (University of Waterloo)
Coles, Matthew (University of British Columbia)
de Vries, Gerda (University of Alberta)
DeDieu, Lauren (University of Calgary)
Desaulniers, Shawn (University of Alberta)
Doolittle, Edward (First Nations University of Canada)
Dyer, Danny (Memorial University of Newfoundland)
Forrest, Brian (University of Waterloo)
Graves, Sean (University of Alberta)
Haskell, Cymra (University of Southern California)
Khan, Steven (University of Alberta)
Leung, Fok-Shuen (University of British Columbia)
Malloch, Amanda (University of Victoria/ Camosun College)
Marken, Kari (University of British Columbia)
Mayes-Tang, Sarah (University of Toronto)
Menz, Petra (Simon Fraser University)
Piccolo, Costanza (University of British Columbia)
Sargent, Pam (Yale University)
Smith, Brett (Yale University)
Wolczuk, Dan (University of Waterloo)
Zazkis, Rina (Simon Fraser University)

Open Education Resources and Technologies in Mathematics
July 26 - 28, 2019

Organizers:

Sean Fitzpatrick (University of Lethbridge)

Jeremy Sylvestre (University of Alberta)

Open Education Resources are educational materials, including textbooks and videos, that are published under open licenses. OER is flexible, affordable, and increasingly, of comparable quality to commercial resources. Faculty who choose to use OER do so not only because it saves their students money, but also because it allows them the freedom to create custom course materials that are precisely tailored to their syllabus. This workshop provided an opportunity for OER advocates in Alberta and beyond to work together to ensure that OER of the highest quality are available to our students.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2268

Participants:

Beezer, Rob (University of Puget Sound)
Davidson, Michelle (University of Manitoba)
Desaulniers, Shawn (University of Alberta)
Doob, Michael (University of Manitoba)
Farmer, David (American Institute of Mathematics)
Feaver, Amy (The King's University)
Fitzpatrick, Sean (University of Lethbridge)
Forrest, Brian (University of Waterloo)
Frei, Christoph (University of Alberta)
Glin, Danny (University of Calgary)
Jordan, Alex (Portland Community College)
Kooistra, Remkes (The Kings University)
Laflamme, Claude (University of Calgary)
Lamoureux, Michael (University of Calgary)
Morris, Joy (University of Lethbridge)
Peschke, George (University of Alberta)
Petry, Robert (University of Regina)
Pierce, Virgil (University of Northen Colorado)
Rechnitzer, Andrew (University of British Columbia)
Rosoff, Dave (College of Idaho)
Sylvestre, Jeremy (University of Alberta)
Thangarajah, Pamini (Mount Royal University)
Walls, Patrick (University of British Columbia)
Wilson, Nicole (University of Lethbridge)

Mathematics and Computer Science in Modeling and Understanding of Structure and Dynamics of Biomolecules
August 9 - 11, 2019

Organizers:

Jozef Adam Liwo (University of Gdansk)
Gabriel Del Rio (UNAM)
François Major (Université de Montréal)

Understanding the principles that make biological molecules form unique structures that ultimately shape all forms of life on the Earth, and how they move to power the complex cellular machinery is of key importance not only because of the continuous quest of mankind to understand the world but also for purely utilitarian reasons: fighting cancer and hereditary diseases, producing better and more resistant crops, and designing techinques to produce goods and energy in a way that would not lead to the destruction of Earth' biosphere. Numbers and principles of geometry, which essentially constitute the basics of Mathematics, have since ancient times been proved to be the most compact and poweful language to describe Nature.

However, mathematicians and natural scientists often speak different languages, sometime mutually un-intelligible as Mandarin Chinese and Latin, this being one of the major obstacles to the development of natural sciences. This workshop brought together mathematicians, chemists, biologists, computer scientists, physicists so that they could exchange ideas and share experience. We believe that the best science emerges when various disciplines interact and combine their ideas. Advances of sciences are never isolated achievements, but only possible when various disciplines come together.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2257

Participants:

Arciniega, Marcelino (Univesidad Autonoma de Mexico)
Bidone, Tamara (University of Utah)
Boniecki, Michał (International Institute of Molecular and Cell Biology in Warsaw)
Brizuela, Carlos (Centro de Investigación Científica y de Educación Superior de Ensenada)
Chirikjian, Gregory (National University of Singapore and Johns Hopkins University)
Cieplak, Marek (Polish Academy of Science)
Del Rio, Gabriel (UNAM)
Fontove, Fernando (C3 Idea)
He, Yi (University of New Mexico)
Hernández Rosales, Maribel (National Autonomous University of Mexico)
Hyeon, Changbong (Korea Institute for Advanced Study)
Jernigan, Robert (Iowa State University)
Karczynska, Agnieszka (University of Gdansk)
Kihara, Daisuke (Purdue University)
Lipska, Agnieszka (University of Gdańsk)
Liwo, Jozef Adam (University of Gdansk)
Lubecka, Emilia (University of Gdańsk)
Ozkan, Banu (Arizona State University)
Pastor, Nina (Universidad Autonoma del Estado de Morelos)
Vakser, Ilya (University of Kansas)
Wu, Zhiyun (Iowa State University)

Canadian Workshop on Linked Open Data for Cultural Scholarship September 13 - 15, 2019

Organizers:

Denilson Barbosa (University of Alberta)

Susan Brown (University of Guelph)

Human brains work through a vast web of interconnections, but the web that researchers increasingly use to understand human culture and history is not nearly as dense. Worse, most internet links simply state where content is. Semantic Web technologies make those links meaningful, by representing not only pointers to content but also properties of such content, expressed as assertions (aka, triples), with proper semantics and encoded using the Resource Description Framework (RDF) data format. RDF data is meaningful to humans and also to machines and has given rise to the ever increasing Linked Open Data (LOD) movement.

The workshop brought together renowned experts from the Digital Humanities and from Computing Science to discuss how LOD can transform research in the humanities in Canada. The workshop also kickstarted the Linked Infrastructure for Networked Cultural Scholarship (LINCS) project, a 3-year international, multi-institution and interdisciplinary project aimed at providing a national data store with an emphasis on Canadian content, and an LOD tool suite for its use and ongoing expansion, that will propel Canada to the lead in mobilizing cultural datasets for basic and translational humanities research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2276

Participants:

Allison-Cassin, Stacy (York University)
Antoniuk, Jeffery (University of Alberta)
Barbosa, Denilson (University of Alberta)
Bath, Jon (University of Saskatchewan)
Brown, Susan (University of Guelph)
Chateau-Dutier, Emmanuel (Université de Montreal)
Crompton, Constance (University of Ottawa)
Dunn, Heather (Canadian Heritage Information Network)
Elford, Jana (Medicine Hat College)
Farnel, Sharon (University of Alberta)
Frishkopf, Michael (University of Alberta)
Fujinaga, Ichiro (McGill University)
Goddard, Lisa (University of Victoria)
Hedley, Alison (McGill University)
Jakacki, Diane (Bucknell University)
Jenstad, Janelle (University of Victoria)
Levy, Michelle (Simon Fraser University)
MacDonald, Natalie (Canadian Research Knowledge Network)
Mandell, Laura (Texas A&M University)
Martin, Kimberley (University of Guelph)
McGregor, Carlos (University of Toronto)
Meagher, Michelle (University of Alberta)
Murphy, Shawn (Nooron Collaboratory Inc.)
Patel-Schneider, Peter (Samsung)
Quamen, Harvey (University of Alberta)
Reder, Deanna (Simon Fraser University)
Rockwell, Geoffrey (University of Alberta)
Stacey, Deborah (University of Guelph)
Suhonos, MJ (Ryerson University)
Tarpley, Bryan (Texas A&M University)

Retreat for Young Researchers in Probability and areas of Application
September 27 - 29, 2019

Organizers:

Edwin Perkins (University of British Columbia)

Christopher Hoffman (University of Washington)

Probability is a powerful technique which plays a central role in modelling in finance, genetics, and physics. This small meeting gathered together some of the most promising young researchers in probability in W. Canada and Washington State, together with leading Faculty from U. Washington, University of British Columbia, U. Alberta and U. Calgary. The topics ranged from theoretical advances on random surfaces to random dynamical systems to recent applications in mathematical finance.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/2-day-workshops/19w2282

Participants:

Barlow, Martin (University of British Columbia)
Budzinski, Thomas (University of British Columbia)
Chen, Yu-Ting (University of Victoria)
Guo, Qi (University of Calgary)
Hoffman, Christopher (University of Washington)
Hong, Jieliang (University of British Columbia)
Horan, Joseph (University of Victoria)
Hu, Yaozhong (University of Alberta)
Kozdron, Michael (University of Regina)
Liu, Shuo (University of Alberta)
Min, Li (University of Alberta)
Perkins, Edwin (University of British Columbia)
Qi, Weiwei (University of Alberta)
Rajulapati, Chandra (University of Saskatchewan)
Ray, Gourab (University of Victoria)
Richey, Jacob (University of Washington)
Rosenberg, Josh (University of Washington)
Sénizergues, Delphin (University of British Columbia)
Sezer, Deniz (University of Calgary)
Shen, Zhongwei (University of Alberta)
Spinka, Yinon (University of British Columbia)
Wang, Shirou (University of Alberta)
Wang, Xiong (University of Alberta)
Wei, Wenning (University of Calgary)
Yi, Yingfei (University of Alberta)
Yi, Yulian (University of Alberta)

Banff International Research Station

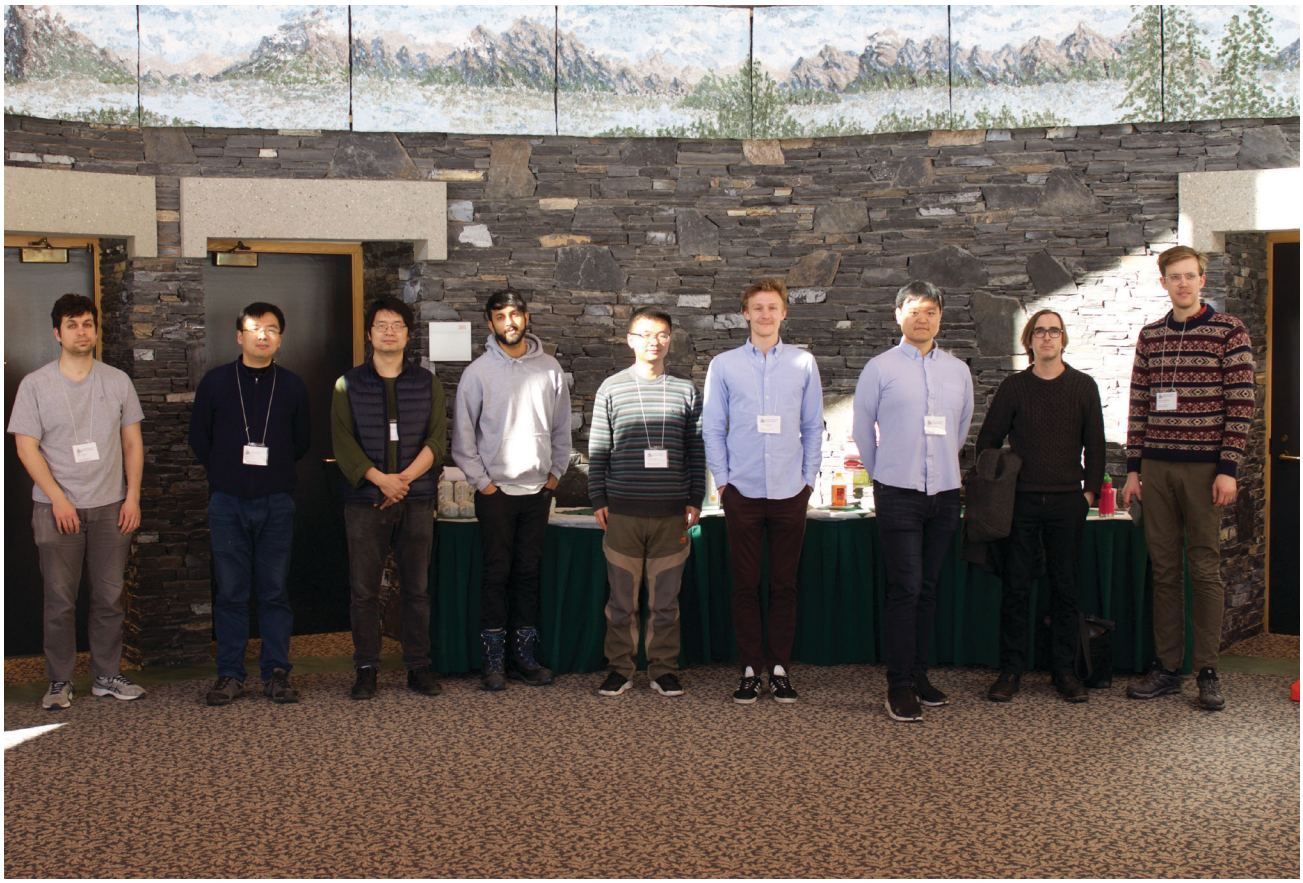
2019

Focussed Research Groups

Quantum Field Theory and Factorization Algebras
February 17 - 24, 2019

Organizers:

Philsang Yoo (Yale University)
Dylan Butson (University of Toronto)
Kevin Costello (Perimeter Institute)
Si Li (Tsinghua University)



Quantum field theory is a framework in physics used to describe elementary particles at very small length scales and high energies, where both quantum mechanical and relativistic effects must be taken into account. Additionally, many ideas from quantum field theory have been used to motivate new conjectures and tools in various areas of pure mathematics, such as algebraic and geometric topology, algebraic geometry, and representation theory.

Factorization algebras are one of the most promising mathematical avatars of quantum field theory, and this workshop aimed to develop a few crucial remaining techniques in the factorization framework for streamlining the relationship between quantum field theories and their applications in modern mathematics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg244

Participants:

Albert, Ben (Perimeter Institute)
Butson, Dylan (University of Toronto)
Costello, Kevin (Perimeter Institute)
Li, Si (Tsinghua University)
Li, Qin (Southern University of Science and Technology)
Williams, Brian (Northeastern University)
Yoo, Philsang (Yale University)
Zhou, Yehao (Perimeter Institute for Theoretical Physics)

Towards Spacetime Entanglement Entropy for Interacting Theories
March 31 - April 7, 2019

Organizers:

Yasaman Yazdi (University of Alberta)
Ravi Kunjwal (Perimeter Institute for Theoretical Physics)
Heidar Moradi (University of Cambridge)

In quantum theory it is possible to establish correlations between different regions of spacetime that are stronger than anything achievable in pre-quantum physics. These correlations exist because of a particularly counter-intuitive feature of the theory, namely, entanglement. Entanglement entropy is a standard measure that quantifies the strength of the correlations due to quantum entanglement. However, although this quantity is quite commonly used in the context of quantum systems restricted to spatial regions, it is particularly tricky to calculate it in the problems that arise in quantum gravity which require “spacetime” regions. Progress made in the past for the case of relatively simple non-interacting theories (called ``gaussian theories”) provides clues on how to extend such methods for calculating the spacetime entanglement entropy to the case of interacting theories. Our project sought to advance this frontier by providing a formulation of spacetime entanglement entropy that applies to a large class of interacting theories that are conformal field theories. This will open up the study of various problems in quantum gravity and cosmology -- such as the microscopic origin of black hole entropy -- enabled by our proposed research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg247

Participants:

Chen, Yangang (University of Waterloo)
Kunjwal, Ravi (Perimeter Institute for Theoretical Physics)
Moradi, Heidar (University of Cambridge)
Yazdi, Yasaman (University of Alberta)
Zilhão, Miguel (University of Lisbon)

Learning and Animal Movement
April 25 - May 5, 2019

Organizers:

Mark Lewis (University of Alberta)

Bill Fagan (University of Maryland)

A key problem in animal ecology is quantification of how animals 'learn to move.' That is, how do naïve animals—with no experience in a particular landscape—obtain information about that area and adapt their movements to more fully exploit it, or decide to move elsewhere? Key mathematical challenges in this discussion are the need for models that include 1) explicit time-dependence, to account for the progressive increase in landscape familiarity and/or 2) social behaviors, which allow for interactions and information transfer among individuals. A deeper understanding of learning and animal movement will help inform the human-mediated management of species at risk (eg., woodland caribou, giant pandas).

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg242

Participants:

Auger-Methe, Marie (University of British Columbia)
Fagan, Bill (University of Maryland)
Frair, Jacqueline (SUNY ESF Roosevelt Wild Life Station)
Fryxell, John (University of Guelph)
Gros, Claudius (Goethe University)
Gurarie, Elie (University of Maryland)
Healy, Susan (University of St Andrews)
Lewis, Mark (University of Alberta)
Merkle, Jerod (University of Wyoming)

Mathematical Theories of the Madden-Julian Oscillation
May 12 - 19, 2019

Organizers:

Boualem Khouider (University of Victoria)

The Madden-Julian oscillation is an atmospheric phenomenon that occurs as a fluctuation in winds, precipitation, and temperature with a period of 30 to 90 days over the tropical Indian Ocean/Western Pacific warm pool. The life of many many millions of people who live in those tropical areas depend of the fluctuations of such intraseasonal oscillations of atmospheric variability yet our state-of-art climate models fail to provide accurate predictions on these scales. The MJO is also known to affect the genesis of tropical cyclones and has a significant influence on the development of EL Niño and many other tropical extra-tropical teleconnection patterns.

A theoretical understanding through simplified mathematical models is key to gaining insight and the understanding needed to improve these models. An international team of experts from the universities of Hawaii, Michigan, UC Davis, and Victoria and from the US National Oceanic and Atmospheric Administration are gathered at the Banff International Research station to focus of the recent developments in the theory of the Madden Julian Oscillation in order to compare and assess some of the most recent successful and yet somewhat conflicting mathematical models and come up with explanations on how to reconcile these theories and potentially provide novel ideas and recommendations for the future generations of climate models.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg269

Participants:

Adames-Corraliza, Angel (University of Michigan)
Khouider, Boualem (University of Victoria)
Yang, Da (University of California Davis)
Zhang, Chidong (Pacific Merine Environmental Laboratory)

Concentration, Relaxation and Mixing time for Restricted Lattices
May 19 - 26, 2019

Organizers:

Prasad Tetali (Georgia Institute of Technology)
Louigi Addario-Berry (McGill University)
Anna Ben-Hamou (Paris 6 University)
Sergey Bobkov (University of Minnesota)

Card shuffling has long fascinated mathematicians, magicians and the general public alike. While mathematicians now understand and can explain many aspects of shuffling a deck of cards to great detail, they/we are stumped when it comes to a rigorous understanding of shuffling other similar combinatorial structures -- for example, the so-called 312-avoiding permutations, enumerated by the Catalan number -- or restricted subsets of well-studied spaces, as in monotone subsets of the Boolean lattice. Thus a case in study is “shuffling” a set of objects whose counting function is the famous Catalan number. The ubiquity of this number is well-documented by a recent book of Richard Stanley, with its 219 interpretations of the Catalan number.

This focused research group attempted to solve some of the simplest-to-state, yet the most vexing and perplexing problems concerning the mixing time of specific Markov chains and the probabilistic and combinatorial structures of the corresponding state spaces; these include random walks on restrictions of the hypercube (or the Boolean lattice) and the non-crossing partition lattice. The topic is at the intersection of probability (Markov chains, free probability), statistics (random sampling and estimation), enumerative combinatorics, and theoretical computer science (property testing and randomized algorithms).

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg225

Participants:

Angel, Omer (University of British Columbia)
Ben-Hamou, Anna (Paris 6 University)
Cohen, Emma (Center For Communications Research)
Roberto, Cyril (Université Paris Nanterre)
Samson, Paul Marie (Paris Est Marne-la-Vallée)
Stauffer, Alexandre (Universita Roma Tre)
Tetali, Prasad (Georgia Institute of Technology)

Analytical Methods for Financial Systemic Risk
May 26 - June 2, 2019

Organizers:

Tom Hurd (McMaster University)
Nils Detering (University of California - Santa Barbara)
Sebastian Jaimungal (University of Toronto)

The participants of this focussed research group were all researchers at a senior level. We fully discussed dissemination of the results to a broad range of more junior researchers within the economics, finance and science communities. In particular, during the week we worked actively on a roadmap for future SR conferences and workshops. For a start, we proposed a full-scale BIRS workshop in SR, to be held at the earliest opportunity.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg270

Participants:

Buckley, Ian (Canadian Securities Transition Office)
Detering, Nils (University of California, Santa Barbara)
Feinstein, Zachary (Washington University - St. Louis)
Halaj, Grzegorz (Bank Canada)
Hurd, Tom (McMaster University)
Meyer-Brandis, Thilo (LMU München)

Permutation Polynomials over Finite Fields
June 9 - 16, 2019

Organizers:

Ariane Masuda (New York City College of Technology)
Daniele Bartoli (Università degli Studi di Perugia)
Steven Wang (Carleton University)

This workshop was a satellite event of The 14th International Conference on Finite Fields and Their Applications to be held in Vancouver, June 3-7, 2019. This workshop gathered a group of eight researchers interested in permutation polynomials over finite fields to work on problems of significant importance that require synergetic efforts of experts in the area. A major problem is to find classes of permutation polynomials over finite fields. In 2009 Akbary, Ghioca, and Wang introduced the concept of index of a polynomial to study the distribution of permutation polynomials over finite fields. They showed that the density of permutation polynomials in the set of polynomials with prescribed index and exponents is higher when the index is smaller. Since then, many authors have explored the index of a polynomial in a variety of questions, not only about permutation polynomials. Very recently, Wang wrote a survey on the index approach where a long section is dedicated to classifying permutation polynomials from over 60 papers based on their indices. We note that many results in these papers do not mention the index of the polynomials involved explicitly. So this survey is an important and major step in trying to organize the many existing permutation polynomials. It comes to confirm that the index approach is very promising, and it provides a rich source of directions of research. This workshop gave a group of researchers the unique opportunity to interact, concentrate efforts, and focus on problems related to the classification of permutation polynomials based on their indices. We expected this gathering to be very productive and result in meaningful publications that will be valuable for the research community.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg263

Participants:

Bartoli, Daniele (Università degli Studi di Perugia)
da Silva Reis, Lucas (University of Sao Paulo)
Hou, Xiang-Dong (University of South Florida)
Li, Lisha (Carleton University)
Masuda, Ariane (The City University of New York)
Quoos, Luciane (Universidade Federal do Rio de Janeiro)
Wang, Qiang (Carleton University)
Wang, Yanping (Carleton University)

Extremal Blaschke Products
June 23 - 30, 2019

Organizers:

Thomas Ransford (Laval University)

Anne Greenbaum (University of Washington)

Finite Blaschke products are rational functions (quotients of polynomials) whose zeros lie in the unit disk, and which have modulus one on the unit circle. In many ways, they play the same role with respect to the unit disk that polynomials play in the complex plane. The numerical range of a matrix is a convex set of numbers that both contains the eigenvalues and encodes numerous other properties of the matrix. Recent work in matrix theory has brought to light interesting connections betweennumerical ranges and finite Blaschke products.

The Blaschke products that arise via such connections are extremal in a certain sense. We expected that the study of these extremal Blaschke products would provide insight into a wide range of questions in matrix theory and complex analysis, including a related well-known open problem called the Crouzeix conjecture.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg254

Participants:

Bickel, Kelly (Bucknell University)
Gorkin, Pamela (Bucknell University)
Greenbaum, Anne (University of Washington)
Ransford, Thomas (Laval University)
Schwenninger, Felix (University of Hamburg)
Wegert, Elias (Technische Universität Bergakademie Freiberg)

Novel Mathematical & Statistical Approaches to predicting Species' Movement under Climate Change
July 14 - 21, 2019

Organizers:

Noelle Beckman (Utah State University)

Michael Neubert (Woods Hole Oceanographic Institution)

Temperature is an important determinant of a species' geographic range. Increasing temperature is one signature of anthropogenic climate change and in order to survive, species will need either to track suitable climate in space---at estimated poleward speeds ranging from 0.08 to 1.26 km yr−1 depending on the region---or adapt to the new local climate. This effect of climate change (combined with others) has been predicted to increase the risk of extinction of up to 60% of animal and plant species if global temperatures exceed 2.0ºC. We aim to develop novel quantitative methods to predict how changes in temperature will influence the ability of plants to track shifting habitats in response to climate change. The ability to predict species responses to changing environments are necessary to inform management decisions.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg248

Participants:

Beckman, Noelle (Utah State University)
Bogen, Sarah (Utah State University)
Bullock, James (NERC Centre for Ecology and Hydrology)
Lewis, Mark (University of Alberta)
Neubert, Michael (Woods Hole Oceanographic Institution)
Zhou, Ying (Lafayette College)

The Voganish Project
July 11 - 18, 2019

Organizers:

Clifton Cunningham (University of Calgary)
Andrew Fiori (University of Lethbridge)
Ahmed Moussaoui (Université Versailles Saint-Quentin)
Bin Xu (Tsinghua University)

The last 10 years have seen dramatic progress in the Langlands program for p-adic groups, partly due to the introduction of Arthur packets. Since Arthur packets are defined only for inner forms of quasisplit classical groups, and well understood mainly for quasisplit classical groups themselves, the current scope of the Langlands correspondence is limited to these groups and admissible representations of Arthur type. The Voganish Project sought to extend these notions using a microlocal study of perverse sheaves on a moduli space of Langlands parameters.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/focussed-research-groups/19frg277

Participants:

Cunningham, Clifton (University of Calgary)
Dijols, Sarah (Tsinghua University)
Fiori, Andrew (University of Lethbridge)
Kitt, Nicole (University of Calgary)
Moussaoui, Ahmed (Université Versailles Saint-Quentin)
Tam, Geo Kam-Fai (Radboud Universiteit)
Vooys, Geoff (University of Calgary)
Xu, Bin (Tsinghua University)
Zhang, Qing (University of Calgary)

Banff International Research Station

2019

Research in Teams

An Optimal Transport Approach to Crop Root Systems and related Multiscale Structures
January 20 - 27, 2019

Organizers/Participants:

Young-Heon Kim (University of British Columbia)
Brendan Pass (University of Alberta)
Dave Schneider (University of Saskatchewan)

Given the root systems of several plants with identical genotypes (geneome sequence) and grown in the same environment, how does one construct a "typical" representative of the set? What about variation within the set? How might one assess whether root systems of different genotypes are similar or different? Answers to these questions is a crucial step towards understanding the relationship between genotypes and phenotypes, and may potentially be used to choose genotypes to optimize certain phenotype dependent properties of root systems

This team meeting was to boost up the new collaboration in this direction between two mathematicians and one computational biologist. Our objective for this intensive research period was to develop a mathematical model and related methods that are suitable for analyzing the complex systems of roots in biologically meaningful ways.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit265

Analysis and geometry of several complex variables
April 14 - 21, 2019

Organizers/Participants:

Malabika Pramanik (University of British Columbia)
Alexander Nagel (University of Wisconsin - Madison)

Bergman kernels are important objects in the study of multivariate complex domains and associated function spaces. The purpose of this project was to provide sharp estimates for the Bergman kernel for log-convex Reinhardt domains. The aim is to quantify the relation between the blow-up of the kernel near the boundary with the geometry of the domain.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit242

Stability of Multidimensional Waves
June 2 - 9, 2019

Organizers:

Stephane Lafortune (College of Charleston)

Anna Ghazaryan (Miami University)

This workshop dealt with the concept of stability. Stability is a fun- damental concept in physics. An illustration of this concept is given by trying to make a pencil stand on its lead. In theory, it is possi- ble but, in practice, because it is such an unstable state, it cannot be done. In the example just described, the study of stability is very simple and there is no need for a mathematical analysis to prove or disprove the stability of the system. The concept of stability carries over to solutions of differential equations such as the ones forming the combustion models mentioned above. In this context, the concept of stability takes an abstract form and its study often involves some so- phisticated mathematical tools. However, such a study is fundamental because only stable solutions can be seen experimentally, i.e. seen in a real-life event. Unstable solutions, just like in the case of the pencil explained above, although exist in theory will never be observed.

The goal of the project was to study stability of certain special solutions to systems of partial differential equations posed on multidimensional domains. These system of equations serve as mathematical models for natural phenomena or experiments. For example, one of the models our analysis was applicable to deals with the phenomenon of gas combustion in a porous medium.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit022

Participants:

Ghazaryan, Anna (Miami University)
Lafortune, Stephane (College of Charleston)
Latushkin, Yuri (University of Missouri)
Manukian, Vahagn (Miami University-Hamilton)

p-adic Dynamics of Hecke Operators
June 16 - 23, 2019

Organizers/Participants:

Eyal Goren (McGill University)
Payman Kassaei (King's College London)
Ricardo Menares (Pontificia Universidad Católica de Chile)
Juan Rivera-Letelier (University of Rochester)

The study of symmetries, starting with Klein and Hilbert in the late 19th century is of central importance to number theory. One is interested in behaviour of points in a space under its group of "generalized symmetries"; this idea is central to theories such as ergodic theory and dynamical systems that originated with problems in physics, but also to number theory where the symmetries are very much related to Diophantine equations. Mostly this study is done on manifolds in the usual Euclidean space that takes its structure from the usual space in which we live; however, number theory provides us with new exotic spaces and new exotic geometries -- p-adic numbers, p-adic analysis, p-adic manifolds -- that in a certain perspective serve as tools to study local behaviour of complicated global symmetries originating in Euclidean spaces. Our interest was precisely in developing such a theory in the context of very particular spaces and symmetries; to be precise, p-adic Shimura varieties and p-adic Hecke operators.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit245

Counting V-Tangencies and Nodal Domains
June 30 - July 7, 2019

Organizers/Participants:

Suresh Eswarathasan (McGill University/Cardiff University)

Igor Wigman (King's College London)

First observed by the physicist and musician Ernst Chladni in the 18th century, nodal sets of Laplace eigenfunctions appear in many mathematical problems as well as those stemming from engineering, physics and natural sciences.

The workshop focused on nodal sets corresponding to a random ensemble of spherical harmonics on S^2 and providing a mathematically rigorous answer for a question related to their topology, namely the statistics for the components of the nodal set with a fixed number of vector field tangencies.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit271

Serre Weight Conjectures for p-adic Unitary Groups
July 7 - 14, 2019

Organizers/Participants:

Stefano Morra (Université Paris 8)

Karol Koziol (University of Alberta)

The Langlands program is a wide reaching series of conjectures predicting that classical objects from harmonic analysis (e.g. modular forms) can be characterized using symmetries of algebraic equations (e.g. Galois representation). Among its most spectacular materialization is the proof of Fermat's Last Theorem and the Shimura--Taniyama--Weil conjecture (the celebrated statement that "all elliptic curves over Q are modular''). Such results require the study of congruences between modular forms and Galois representations, following an insight of J-P. Serre in the 70s. However, it was not until the work of Breuil in the early 2000s that a precise formulation of a "mod p and p-adic Langlands program" was made for the group GL2, with subsequent applications to the Fontaine-Mazur conjecture and the Breuil-Mézard conjecture.

We aimed to formulate a systematic approach for mod p functoriality, and use the recent advances in modularity for GLn to obtain new results towards a still unexplored mod p and p-adic Langlands program for unitary groups.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit273

Dispersion Interactions via Optimal Transport
September 29 - October 6, 2019

Organizers/Participants:

Augusto Gerolin (Vrije Universiteit Amsterdam)

Mircea Petrache (Pontificia Universidad Católica de Chile)

Accurately predicting electronic structure from first principles is crucial for many research areas such as chemistry, solid-state physics, biophysics and material sciences. In principle, the electronic structure is determined by the Schrödinger equation, which can only be solved in practice for few electrons. Kohn-Sham (KS) Density functional theory (DFT) has been a real breakthrough for electronic structure calculations. KS DFT uses the one-electron density and a non-interacting wave function as basic variables, much simpler quantities than many-electron wave-functions, allowing to treat realistic molecular systems.

However, present-day KS DFT is not yet able to accurately capture the physics of systems in which electronic correlation plays a prominent role (e.g. transition metals, which are the workhorse of catalysis). In recent years, the theoretical chemists have developed a formalism to deal with Density Functional Theory for strongly correlated electronic systems (SCE), based on the exact DFT limit of infinite coupling strength. The mathematical theory of optimal transport for finitely many marginals provides a rigorous framework for studying such kind of problem from a rigorous analytical viewpoint.

This team meeting was to develop a new mathematical formalism allowing to study intermolecular forces in atoms and molecules in the framework of Density Functional Theory.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit280

Signal Processing on Graphs
October 27 - November 3, 2019

Organizers/Participants:

Jeannette Janssen (Dalhousie University)

Mahya Ghandehari (University of Delaware)

Signal processing is what makes it possible to transform the music played by your favourite band into an mp3 file on your phone, and then convert it back to music in your ear. An important tool in this process is a brand of mathematics called Fourier analysis. Over the last 200 years, Fourier analysis has developed into a rich theory, with great practical applications.

The framework of Fourier analysis works great signals that vary continuously in time (musical sound) or in space (pixel encoding of an image). But more and more, signals occur on networks: the network of brain connections, for example, or the physical Internet. To extend signal processing to networks (which mathematicians call graphs), new mathematical tools are needed that combine the ‘continuous’ with the ‘networked’ approach. The goal of this project was to develop such tools.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/research-in-teams/19rit279

CMO 2019 Program

5-Day Workshops 2019

Apr 28	May 3	Geometrical Tools for String Cosmology
May 5	May 10	G2 Geometry and Related Topics
May 12	May 17	Symbolic Dynamical Systems
May 19	May 24	Scaling Limits of Dynamical Processes on Random Graphs
May 26	May 31	Flat Surfaces and Dynamics on Moduli Space, II
Jun 2	Jun 7	Topological Phases of Interacting Quantum Systems
Jun 9	Jun 14	Hamiltonian PDEs: KAM, Reducibility, Normal Forms and Applications
Jun 16	Jun 21	Ordered Groups and Rigidity in Dynamics and Topology
Jun 23	Jun 28	Women in Geometry 2
Jul 28	Aug 2	Time-like Boundaries in General Relativistic Evolution Problems
Aug 4	Aug 9	Set theory of the Reals
Aug 11	Aug 16	Number Theory in the Americas
Aug 18	Aug 23	Out-of-Equilibrium Processes in Evolution and Ecology
Sep 1	Sep 6	Tilting Theory, Singularity Categories, & Noncommutative Resolutions
Sep 8	Sep 13	Tropical Methods in Real Algebraic Geometry
Sep15	Sep 20	Reverse Mathematics of Combinatorial Principles
Sep 22	Sep 27	Multi-Stage Stochastic Optimization for Clean Energy Transition
Sep 29	Oct 4	Soft Packings, Nested Clusters, and Condensed Matter
Oct 6	Oct 11	Helly and Tverberg type Theorems
Oct 20	Oct 25	Modularity and Moduli Spaces
Oct 27	Nov 1	Computational Harmonic Analysis and Data Science
Nov 3	Nov 8	Recent Developments in Mathematical and Computational Biomedicine
Nov 10	Nov 15	Zero-Sum Ramsey Theory: Graphs, Sequences and More
Nov 17	Nov 22	Moduli and Invariants
Dec 1	Dec 6	Algebraic and Geometric Categorification

Geometrical Tools for String Cosmology
April 28 - May 3, 2019

Organizers:

Ivonne Zavala (Swansea University)
Xenia de la Ossa (University of Oxford)
Magdalena Larfors (Uppsala University)

In the past decades, string theory and supergravity have evolved to provide a robust mathematical framework for phenomenological studies of physics. This workshop brought together international experts working on cosmology, supergravity and string theory to provide a solid mathematical and theoretical foundation for the description of the early Universe. During the workshop, we explored new advances in the mathematical and geometrical developments of string theory and supergravity as a tool to make progress in the field of string cosmology.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5094

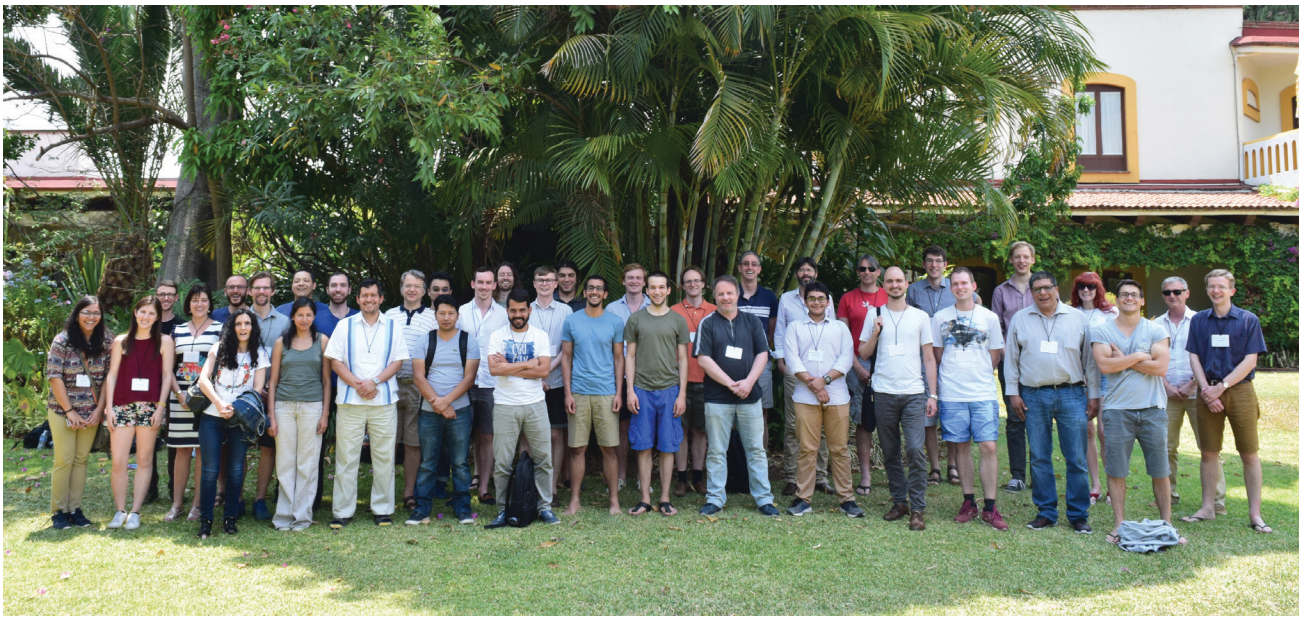
Participants:

Bachlechner, Thomas (University of California - San Diego)
Bergshoeff, Eric (University of Groningen)
Burgess, Cliff (McMaster University)
Cabo Bizet, Nana (Universidad de Guanajuato)
Candelas, Philip (University of Oxford)
Chakraborty, Dibya (Universidad de Guanajuato)
Cicoli, Michele (Università di Bologna)
Damián Ascencio, César (Universidad de Guanajuato)
Dibitetto, Giuseppe (Uppsala Universitet)
Geshnizjani, Ghazal (University of Waterloo)
Giri, Suvendu (Uppsala University)
Graña, Mariana (CEA Saclay)
Jaime, Luisa G. (UNAM)
Jiménez Santana, Yulier (Universidad de Guanajuato)
Larfors, Magdalena (Uppsala University)
León Bonill, Jorge Gabriel (Universidad de Guanajuato)
Linares Cedeño, Francisco Xavier (Universidad de Guanajuato)
Loaiza-Brito, Oscar (Universidad de Guanajuato)
Long, Cody (Northeastern University)
Lukas, Andre (University of Oxford)
Marquez Morales, Juan Manuel (Universidad de Guanajuato)
Martínez Merino, Aldo (Universidad Autónoma de Chiapas)
Mayorga-Peña, Damián (Universidad de Guanajuato)
McAllister, Liam (Cornell University)
Oehlmann, Paul-Konstantin (Simons Center for Geometry and Physics / Virginia Tech)
Olguín-Trejo, Yessenia (UNAM)
Parameswaran, Susha (University of Liverpool)
Plauschinn, Erik (Ludwig-Maximilians-Universität München)
Quiroz, Norma (Universidad de Guadalajara)
Ramos Hamud, Mario (UNAM)
Ramos-Sanchez, Saul (UNAM)
Retolaza, Ander (IPhT CEA-Saclay)
Roest, Diederik (University of Groningen)
Rosales, Omar (Universidad de Guanajuato)
Ruehle, Fabian (CERN)
Santos Silva, Roberto (Universidad de Guadalajara)
Sloane, Peter (Universidad Autónoma de Chiapas)
Sypsas, Spyros (Chulalongkorn University)
Tasinato, Gianmassimo (Swansea University)
Toledo Sesma, Leonel (Novosibirsk State University)
Urakawa, Yuko (Nagoya University)
Valenzuela, Irene (Cornell University)
Vennin, Vincent (Université Denis Diderot Paris 7)
Zavala, Ivonne (Swansea University)

G2 Geometry and Related Topics
May 5 - 10, 2019

Organizers:

Jason Lotay (University of Oxford)
Spiro Karigiannis (University of Waterloo)
Conan Leung (Chinese University of Hong Kong)



G2 geometry is an exciting and rapidly developing research area internationally, with links to topics across mathematics and theoretical physics, including geometry, topology, analysis, string theory and M-theory. This workshop aimed to address some of the key open problems in the area by bringing together a diverse range of geometry researchers from around the world, with a particular focus on young and early career researchers, so that they may discuss their results and explore novel approaches, as well as strengthen and form new collaborations.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5145

Participants:

Arizmendi, Gerardo (Universidad de las Américas Puebla)
Aslan, Benjamin (University College London)
Ball, Gavin (Duke University)
Bazzoni, Giovanni (Universidad Complutense de Madrid)
Betancourt, Alejandro (CIMAT)
Charbonneau, Benoit (University of Waterloo)
Cizel, Sebastjan (University of Oxford)
Dixon, Kael (King's College London)
Driscoll, Joe (University of Leeds)
Dwivedi, Shubham (University of Waterloo)
Fino, Anna (Universita di Torino)
Fowdar, Udhav (University College London)
Garcia-Compean, Hugo (CINVESTAV)
Grigorian, Sergey (University of Texas - Rio Grande Valley)
Harland, Derek (University of Leeds)
Haydys, Andriy (University of Freiburg)
Herrera, Rafael (CIMAT)
Holguín Cardona, Sergio Andrés (UNAM)
Karigiannis, Spiro (University of Waterloo)
Kovalev, Alexei (University of Cambridge)
Lambert, Ben (University College London)
Lehmann, Fabian (University College London)
Lotay, Jason (University of Oxford)
Loubeau, Eric (Université de Bretagne Occidentale)
Madnick, Jesse (McMaster University)
Madsen, Thomas (Aarhus University)
Martín-Merchán, Lucía (Universidad Complutense de Madrid)
Moore, Kim (University College London)
Nordstrom, Johannes (University of Bath)
Oliveira, Gonçalo (Universidade Federal Fluminense)
Perales, Raquel (UNAM, Oaxaca)
Platt, Daniel (University College London)
Raffero, Alberto (University of Turin)
Sá Earp, Henrique (Universidade Estadual de Campinas)
Singhal, Ragini (University of Waterloo)
Téllez, Iván (UNAM)
Tsai, Chung-Jun (National Taiwan University)
Villacampa, Raquel (Centro Universitario de la Defensa)

Symbolic Dynamical Systems
May 12 - 17, 2019

Organizers:

Ricardo Gómez Aíza (UNAM)
Ronnie Pavlov (University of Denver)
Anthony Quas (University of Victoria)
Michael Schraudner (University of Chile)

The workshop brought together the theories of ergodicity, group actions, complexity and computability, cellular automata, thermodynamic formalism with its Gibbs measures and phase transitions, and analytic combinatorics, with symbolic dynamics as their main common subject. With a wide range of closely related topics of discussion encompassing one and multidimensional dynamics, decidability, particle models of statistical mechanics and more, the workshop gathered expert scientists and specialists as well as young researchers and postdocs in order to motivate new collaborations that will promote new developments in and contributions to these highly active and fascinating subjects.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5093

Participants:

Alcaraz Barrera, Rafael (Universidad Autónoma de San Luis Potosí)
Antonioli, John (University of Denver)
Austin, Timothy (University of California - Los Angeles)
Barbieri, Sebastián (University of British Columbia)
Bissacot, Rodrigo (University of São Paulo)
Boyle, Mike (University of Maryland)
Briceño, Raimundo (Tel Aviv University)
Bustos, Alvaro (Universidad de Chile)
Castillo-Ramirez, Alonso (Universidad de Guadalajara)
Chandgotia, Nishant (Hebrew university of Jerusalem)
Cortez, Maria Isabel (Universidad de Santiago de Chile)
Cyr, Van (Bucknell University)
de los Santos Baños, Luguis (Universidad Autónoma de San Luis Potosí)
Donoso, Sebastián (Universidad de Chile)
Dykstra, Andrew (Hamilton College)
Frick, Sarah (Furman University)
García Ramos, Felipe (CONACYT - Universidad Autónoma de San Luis Potosí)
Gómez Aíza, Ricardo (UNAM)
Johnson, Aimee (Swarthmore College)
Jung, Uijin (Ajou University)
Kra, Bryna (Northwestern University)
Kwietniak, Dominik (Jagiellonian University)
Lind, Douglas (University of Washington)
López Hernández, Francisco José (UASLP)
Maass, Alejandro (Universidad de Chile)
Maldonado, Cesar (Instituto Potosino de Investigacion Cientifca y Tecnologica)
Medynets, Constantine (United States Naval Academy)
Meyerovitch, Tom (Ben Gurion University of the Negev)
Monsivais, Renata (UNAM)
Petersen, Karl (University of North Carolina)
Quas, Anthony (University of Victoria)
Reyes, Carlos Gustavo (Universidad del Istmo)
Sahin, Ayse (Wright State University)
Salo, Ville (University of Turku)
Schmieding, Scott (Northwestern University)
Schraudner, Michael (University of Chile)
Spinka, Yinon (University of British Columbia)
Taati, Siamak (University of Groningen)
Ugalde, Edgardo (Universida Autonóma de San Luis Potosí)
Yang, Kitty (Northwestern University)
Yoo, Jisang (Sungkyunkwan University)

Scaling Limits of Dynamical Processes on Random Graphs
May 19 - 24, 2019

Organizers:

Grzegorz Rempala (The Ohio State University)
Rick Durrett (Duke University)
Heinz Koeppl (Technische Universitat Darmstadt)
Remco van der Hofstad (Eindhoven University of Technology)

The field "dynamical processes on networks'' is the marriage of two diverse disciplines that have long been studied independently. With the overwhelming proliferation of social networks, never has it been more important to understand and model the spread of rumour, the dissemination of propaganda, or the very behaviour of social networks in general, which is often quite complex and adaptive. As our dependence on computer networks grows, so does the need to better understand and prevent spread of computer viruses. Similarly, incorporating network structure and studying its impact on various epidemic process is also the need of the hour.

In this workshop, we focused on scaling limits of such systems as the size of the network grows arbitrarily large. The main objective of this workshop was to consolidate results developed by different communities into a comprehensive and mathematically rigorous body of work. The workshop also fostered new collaboration among these different communities.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5071

Participants:

Alfaro Montufar, Carlos Alejandro (Banxico)
Banerjee, Sayan (University of North Carolina - Chapel Hill)
Britton, Tom (Stockholms University)
Budhiraja, Amarjit (University of North Carolina - Chapel Hill)
Caines, Peter (McGill University)
Cappelletti, Daniele (ETH Zurich)
Decreusefond, Laurent (Telecom ParisTech)
Dhara, Souvik (Micrsoft Research and MIT)
Disser, Yann (TU Darmstadt)
Durrett, Rick (Duke University)
Ferreira, Silvio C. (Universidade Federal de Viçosa)
Giardina, Cristian (University of Modena and Reggio Emilia)
Gross, Thilo (UC Davis)
Huang, Xiangying (Zoe) (Duke University)
Junge , Matthew (Duke University)
Kenah, Eben (The Ohio State University)
KhudaBukhsh, Wasiur R. (The Ohio State University)
Kim, Jae Kyoung (KAIST)
Koeppl, Heinz (Technische Universitaet Darmstadt)
Kurtz, Thomas (University of Wisconsin)
Linzner, Dominik (TU Darmstadt)
Miller, Joel (La Trobe University)
Mischaikow, Konstantin (Rutgers University)
Nagler, Jan (ETH Zurich)
Ramírez Ramírez, Leticia (CIMAT)
Rempala, Grzegorz (The Ohio State University)
Scarpino, Samuel (Northeastern University)
Sivakoff, David (The Ohio State University)
Van Mieghem, Piet (TU Delft)

Flat Surfaces and Dynamics on Moduli Space, II
May 26 - 31, 2019

Organizers:

Ferran Valdez (UNAM)
Kasra Rafi (University of Toronto)
Barak Weiss (Tel Aviv University)
Anton Zorich (Universite Pierre Diderot)

The classical illumination problem (Straus, 1950) asks whether there exists a polygonal room with a pair of points which do not illuminate each other. Thanks to breakthrough results by A. Eskin, A. Mohammadi & M. Mirzakhani classical illumination problems can now be solved in full generality adapting methods from dynamics on homogeneous spaces to dynamics on the moduli space of at Riemann surfaces.

Despite this enormous progress in the area, there are many central questions regarding Flat Surfaces and Dynamics on Moduli spaces that remain open. This workshop pushed further the techniques developed in the last 5 years to crack these questions in the near future.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5078

Participants:

Aggarwal, Amol (Harvard)
Apisa, Paul (Yale University)
Arana-Herrera, Francisco (Stanford University)
Artigiani, Mauro (Universidad de los Andes)
Athreya, Jayadev (University of Washington)
Bainbridge, Matt (Indiana University)
Calderon, Aaron (Yale University)
Chaika, Jon (University of Utah)
Chen, Dawei (Boston College)
Dozier, Benjamin (Stony Brook University)
Duryev, Eduard (Institut de mathématiques de Jussieu)
Engel, Philip (University of Georgia)
Gendron, Quentin (CMM-UNAM)
Gheorghita, Iulia (Boston College)
Goujard, Elise (Institut de mathématiques de Bordeaux)
Gutierrez-Romo, Rodolfo (Université Paris 7)
Hooper, Pat (City College of New York / CUNY Graduate Center)
Juan Zacarías, José (UNAM)
Leininger, Christopher (University of Illinois - Urbana-Champaign)
Loving, Marissa (University of Illinois at Urbana-Champaign)
Marchese, Luca (Universite Paris 13)
Masur, Howard (University of Chicago)
Möller, Martin (Goethe Universität Frankfurt Am Main)
Monin, Leonid (University of Toronto)
Morales Jiménez, Israel (UNAM-Morelia)
Mullane, Scott (Goethe University)
Pardo, Angel (Universidad de Chile)
Rafi, Kasra (University of Toronto)
Randecker, Anja (University of Toronto)
Rühr, Rene (Technion)
Smillie, John (University of Warwick)
Taha, Diaaeldin (University of Washington)
Telpukhovskiy, Ivan (University of Toronto)
Trevino, Rodrigo (University of Maryland - College Park)
Valdez, Ferran (UNAM)
Weiss, Barak (Tel Aviv University)
Weitze-Schmithuesen, Gabriela (Universitaet des Saarlandes)
Ygouf, Florent (Universite de Grenobles Alpes)
Zykoski, Bradley (University of Michigan)

Topological Phases of Interacting Quantum Systems
June 2 - 7, 2019

Organizers:

Hermann Schulz-Baldes (Universitat Erlangen-Nurnberg)
Emil Prodan (Yeshiva University)
Carlos Villegas-Blas (UNAM)

There is presently a tremendous activity in the field of topological insulators. The first objective will therefore be to disseminate the important results in the field and to survey its state of the art. The second objective will be a comprehensive survey of the open problems and an honest discussion of the limitations of the present approaches. The third objective will be to connect and integrate the frameworks already used by the researchers and hopefully to put forward proposals with potential for a breakthrough in the problem of topological interacting aperiodic systems. For example, to the present day, K-theory, index theory and non-commutative geometry have not yet been applied to interacting systems in a conceptual way and one of the aims of the workshop is to exchange ideas on such matters. The overarching goal of the meeting was to further intensify the contact between mathematical physicists and theoretical physicists working in the field of topological insulators. This is reflected by the mix of the participants, coming both from physics and mathematics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5034

Participants:

Arici, Francesca (Radboud University Nijmegen)
Avron, Yosi (Technion)
Bachmann, Sven (University of British Columbia)
Ballesteros, Miguel (IIMAS Mexico City)
Bols, Alexander (KU Leuven)
Bourne, Chris (Tohoku University)
De Nittis, Giuseppe (Universidad Catolica di Santiago de Chile)
Franco Cordova, Gerardo Martin (UNAM)
Garcia-Compean, Hugo (CINVESTAV)
Gomi, Kiyonori (Shinshu University)
Graf, Gian Michele (ETH Zurich)
Haldane, F. Duncan M. (Princeton University)
Hatsugai, Yasuhiro (Tsukuba)
Hayashi, Shin (National Institute of Advanced Industrial Science and Technology)
Kellendonk, Johannes (Universite Claude Bernard Lyon 1)
Landi, Giovanni (University of Trieste)
Leung, Bryan (University of Berkeley)
Levin, Michael (University of Chicago)
Loring, Terry (University of New Mexico)
Lozano Viesca, Edgar Agustin (UNAM)
Lu, Yuan-Ming (Ohio State University)
Max, Christopher (University of Cologne)
Mesland, Bram (University of Bonn)
Meyer, Ralf (Universität Göttingen)
Mong, Roger (University of Pittsburgh)
Nachtergaele, Bruno (University of California Davis)
Ogata, Yoshiko (University of Tokyo)
Panati, Gianluca (Sapienza Universita di Roma)
Porta, Marcello (University of Tübingen)
Prodan, Emil (Yeshiva University)
Quella, Thomas (University of Melbourne)
Sandoval, Maximiliano (Pontificia Universidad Católica de Chile)
Schulz-Baldes, Hermann (Universitat Erlangen-Nurnberg)
Sontz, Stephen (CIMAT)
Stoiber, Tom (Erlangen)
Thiang, Guo Chuan (University of Adelaide)
Varghese, Mathai (University of Adelaide)
Villegas-Blas, Carlos (UNAM)
Weder, Ricardo (UNAM)
Weingart, Gregor (UNAM)
Young, Amanda (University of Arizona)

Hamiltonian PDEs: KAM, Reducibility, Normal Forms and Applications
June 9 - 14, 2019

Organizers:

Dario Bambusi (Università degli studi di Milano)
Michele Correggi ("Sapienza" University of Rome)
Benoît Grébert (Université de Nantes)
Carlos Villegas-Blas (UNAM)

This workshop brought toghether a strong group of pure mathematicians working on Hamiltonian PDEs with more applied mathematicians, in order to make the point on the state of the art in particular regarding the applications to concrete models. The main goal was double: on the one side to understand the relevance of the theory for the explanation of experimental behaviors; on the other side to bring out new problems and inputs in order to stimulate new directions of development of the theory.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5076

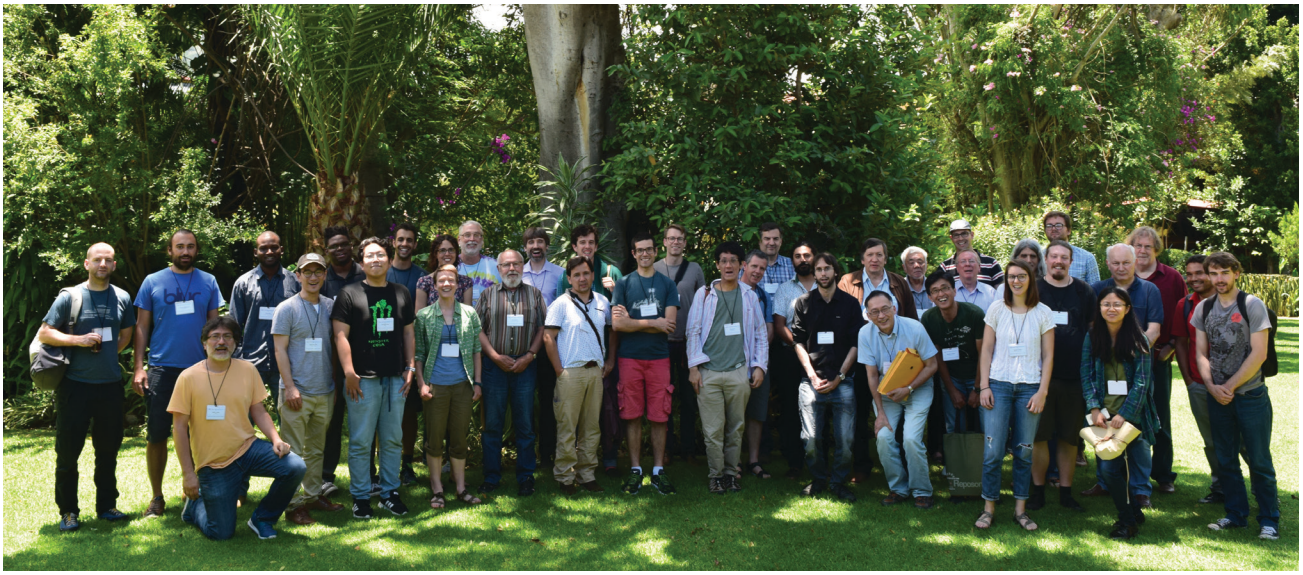
Participants:

Adami, Riccardo (Politecnico di Torino)
Avendaño Camacho, Misael (Universidad de Sonora)
Bambusi, Dario (Università degli studi di Milano)
Bernier, Joackim (Institut de recherche mathématique de Rennes)
Calleja, Renato (UNAM)
Carlone, Raffaele (Università Federico II Napoli)
Correggi, Michele ("Sapienza" University of Rome)
Feola, Roberto (University off Nantes)
García Azpeitia, Carlos (IIMAS-UNAM)
Gazzola, Filippo (Politecnico di Milano)
Giacomelli, Emanuela Laura (Universitaet Tuebingen)
Grébert, Benoît (Université de Nantes)
Guardia, Marcel (Universitat Politècnica de Catalunya)
Gustafson, Stephen (University of British Columbia)
Hani, Zaher (University of Michigan)
Haus, Emanuele (Università di Napoli Federico II)
Kappeler, Thomas (University of Zurich)
Langella, Beatrice (Università degli Studi di Milano)
Lozano Viesca, Edgar Agustin (UNAM)
Martínez del Río, David (IIMAS-UNAM)
Maspero, Alberto (SISSA Trieste)
Massetti, Jessica Elisa (Scuola Normale Superiore di Pisa)
Miot, Evelyne (Université de Grenoble and CNRS)
Montalto, Riccardo (University of Milan)
Naumkin, Ivan (UNAM)
Nguyen, Trung (Universite de Nantes)
Pedroza, Andrés (Universidad de Colima)
Pelinovski, Dmitry (McMaster University)
Peralta-Salas, Daniel (Instituto de Ciencias Matemáticas - Madrid)
Solórzano, Victor Arnaiz (ICMAT (Madrid))
Valdebenito, Dario (McMaster University)
Vargas-Magaña, Rosa (UNAM)
Vilaça da Rocha, Victor (Basque Center for Applied Mathematics)
Villegas-Blas, Carlos (UNAM)
Wayne, Eugene (Boston University)
Yngvason, Jakob (University of Vienna)
You, Jiangong (Nankai University)

Ordered Groups and Rigidity in Dynamics and Topology
June 16 - 21, 2019

Organizers:

Adam Clay (University of Manitoba)
Steven Boyer (Université du Québec à Montréal)
Kathryn Mann (Cornell University)
Cristóbal Rivas (Universidad de Santiago de Chile)



This workshop focused on the connections between several modern fields of mathematics, namely algebra, topology and dynamical systems. At the core of the connection is the idea that a certain mathematical relationship between algebraic objects and the real line (or the circle) can be flexible or rigid. Each of the fields of algebra, topology and dynamical systems has developed their own techniques and ideas for investigating flexibility and rigidity. This workshop aimed to strengthen our understanding by unifying and expanding upon the methods across all fields.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5044

Participants:

Alonso, Juan (Universidad de la Republica Uruguay)
Antolin, Yago (Universidad Autónoma de Madrid)
Ba, Idrissa (Université du Québec à Montréal)
Baik, Hyungryul (KAIST)
Boileau, Michel (Aix Marseille Université)
Boyer, Steven (Université du Québec à Montréal)
Brum, Joaquin (Universidad de la Republica Uruguay)
Cisneros de la Cruz, Bruno A. (UNAM)
Clay, Adam (University of Manitoba)
Culler, Marc (University of Illinois, Chicago)
Dunfield, Nathan (University of Illinois - Urbana-Champaign)
Eudave Munoz, Mario (UNAM)
Eynard-Bontemps, Hélène (Université Pierre et Marie Curie)
Gabai, David (Princeton University)
Gandolfi, Guillaume (Universite de Caen)
Gao, Xinghua (University of Illinois - Urbana-Champaign)
Ghaswala, Tyrone (University of Manitoba)
Gordon, Cameron (University of Texas at Austin)
Guillot, Adolfo (UNAM)
Hu, Ying (University of Nebraska Omaha)
Hyde, James (University of St Andrews)
Ito, Tetsuya (Kyoto University)
Johnson, Jonathan (University of Texas at Austin)
Kim, Sang-Hyun (Seoul National University)
Koberda, Thomas (University of Virginia)
Krishna, Siddhi (Boston College)
Mann, Kathryn (Cornell University)
Matsumoto, Shigenori (Nihon University)
Matte Bon, Nicolás (ETH Zurich)
Morris, Dave (University of Lethbridge)
Motegi, Kimihiko (Nihon University)
Navas, Andres (Universidad de Santiago de Chile)
Paris, Luis (Université de Bourgogne)
Rivas, Cristóbal (Universidad de Santiago de Chile)
Roberts, Rachel (Washington University in St Louis)
Rolfsen, Dale (University of British Columbia)
Segura Aguilar, Joan Carlos (UNAM)
Sunic, Zoran (Hofstra University)
Teragaito, Masakazu (Hiroshima University)
Triestino, Michele (Université de Bourgogne)
Turner, Hannah (University of Texas at Austin)
Watson, Liam (University of British Columbia)

Women in Geometry 2
June 23 - 28, 2019

Organizers:

Catherine Searle (Wichita State University)
Maia Fraser (University of Ottawa)
Elizabeth Stanhope (Lewis and Clark College)
Guofang Wei (University of California - Santa Barbara)

Workshop participants join a tradition of creating original research about the measurement of shapes and the nature of space that is thousands of years old. Modern geometry has grown far beyond Euclid's Elements to include abstract objects that help us understand phenomena ranging from the possible shape of our universe, to how the brain interprets images, to the circulation of air in our atmosphere. As in many other fields of mathematics research, women are seriously underrepresented in Geometry. Following upon the success of the first Women in Geometry workshop in 2015, where new research networks have already led to productive collaboration and novel results, this second Women in Geometry workshop sought to facilitate the collaboration and mentorship that will further increase the strength and visibility of women who are actively pursuing research in Geometry.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5115

Participants:

Alpert, Hannah (Ohio State University)
Bourni, Theodora (University of Tennessee Knoxville)
Capovilla-Searle, Orsola (Duke University)
Clutterbuck, Julie (Monash University)
Contreras Peruyero, Adriana Haydee (UNAM)
De Marchis, Francesca (Sapienza Università di Roma)
Fraser, Maia (University of Ottawa)
Gabach-Clément, Maria Eugenia (Universidad de Córdoba)
Gittins, Katie (Universite de Neuchatel)
Gordon, Carolyn (Dartmouth College)
Graf, Melanie (University of Vienna)
Kerr, Megan (Wellesley College)
Khalile, Magda (Orsay Université)
Lee, Youngae (Kyungpook National University)
Limouzineau, Maylis (Universität zu Köln)
Lin, Yueh-Ju (Wichita State University)
Macbeth, Heather (Massachusetts Institute of Technology)
Membrillo Solis, Ingrid Amaranta (University of Southampton)
Mese, Chikako (Johns Hopkins University)
Murphy, Emmy (Northwestern University)
Nguyen, Xuan Hien (Iowa State University)
Pan, Yu (Massachusetts Institute of Technology)
Perales, Raquel (UNAM, Oaxaca)
Rotman, Regina (University of Toronto)
Saez, Mariel (Pontificia Universidad Catolica de Chile)
Sakovich, Anna (Uppsala university)
Sandoval, Mary (Trinity College)
Searle, Catherine (Wichita State University)
Sinaei, Zahra (University of Massachusetts Amherst)
Stancu, Alina (Concordia University)
Stanhope, Elizabeth (Lewis and Clark College)
Traynor, Lisa (Bryn Mawr College)
VanBlargan, Caroline (John's Hopkins University)
Wei, Guofang (University of California - Santa Barbara)

Time-like Boundaries in General Relativistic Evolution Problems
July 28 - August 2, 2019

Organizers:

Olivier Sarbach (Universidad Michoacana de San Nicolás de Hidalgo)
Piotr Bizon (Jagiellonian University)
Helmut Friedrich (Max Planck Institute for Gravitational Physics)
Oscar Reula (Universidad Nacional de Córdoba)

General Relativity's second century will be marked by the analytical understanding of solutions in non-linear and global scenarios. Such solutions will play a crucial role in our understanding of such a fascinating theory as well as our ability to scrutinize the universe through gravitational waves and to explore strongly coupled field theories through holographic correspondences, to name just but two examples. Achieving such goals most often require dealing with boundaries which can be present deep in the domain of interest or asymptotically. This workshop brought a number of experts in the field as well as young researchers to work, discuss and collaborate to ensure a robust understanding of the problems and solutions associated with the presence of such boundaries within a multidisciplinary/multiexpertise environment.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5140

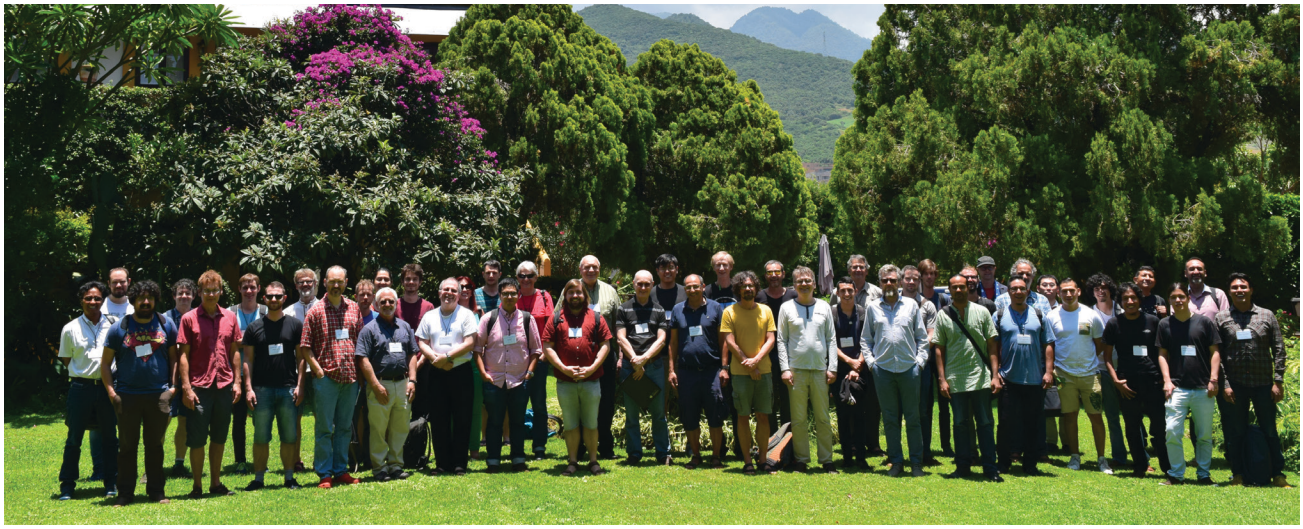
Participants:

Alcubierre, Miguel (UNAM)
Anderson, Michael (SUNY Stony Brook)
Bentivegna, Eloisa (IBM Research)
Bizon, Piotr (Jagiellonian University)
Buchman, Luisa (Caltech)
Cabrera Pacheco, Armando (Universitaet Tuebingen)
Carrasco, Federico (Max Planck Institute for Gravitational Physics)
Dotti, Gustavo (Universidad Nacional de Córdoba)
Evnin, Oleg (Chulalongkorn University)
Frauendiener, Jörg (University of Otago)
Friedrich, Helmut (Max Planck Institute for Gravitational Physics)
Gabach-Clément, Maria Eugenia (Universidad de Córdoba)
Green, Stephen (Albert Einstein Institute Potsdam)
Hilditch, David (Instituto Superior Tecnico - Lisbon)
Kehle, Christoph (Cambridge)
Lau, Stephen (University of New Mexico)
Luk, Jonathan (Stanford University)
Makino, Tetu (Yamaguchi University)
Maxwell, David (University of Alaska Fairbanks)
Oeckl, Robert (UNAM)
Oliynyk, Todd (Monash University)
Olvera-Santamaria, Arturo (Monash University)
Ortiz, Néstor (University of Jena)
Reula, Oscar (Universidad Nacional de Córdoba)
Rostworowski, Andrzej (Jagiellonian University Krakow)
Sarbach, Olivier (Universidad Michoacana de San Nicolás de Hidalgo)
Shao, Arick (Queen Mary University of London)
Smulevici, Jacques (Sorbonne Université)
Warnick, Claude (University of Cambridge)
Witek, Helvi (King's College London)

Set theory of the Reals
August 4 - 9, 2019

Organizers:

Michael Hrusak (UNAM)
Joerg Brendle (Kobe University)
Juris Steprans (York University)



The workshop is designed to explore the strong connection that exists between set theory, algebra and analysis. The set-theoretic methods involved include infinitary Ramsey theory, descriptive set theory and forcing. The focus of the workshop will be on cardinal invariants of the continuum, their applications and relevant forcing techniques, in particular, the higher dimensional matrix iterations, and the method of Boolean ultrapowers. The program brought together senior leaders in the field, and students and junior researchers, especially young mathematicians from Latin America, who would benefit greatly from such an experience.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5064

Participants:

Aspero, David (University of East Anglia)
Bergfalk, Jeffrey (UNAM)
Blass, Andreas (University of Michigan)
Brendle, Joerg (Kobe University)
Brian, Will (University of North Carolina at Charlotte)
Brooke-Taylor, Andrew (University of Leeds)
Castro Bedoya, Yhon Jairo (UNAM)
Chen-Mertens, William (York University)
Chodounsky, David (Institute of Mathematics CAS)
Corral Rojas, César (UNAM)
Cruz Chapital, Jorge Antonio (UNAM)
Dow, Alan (University of North Carolina, Charlotte)
Dzamonja, Mirna (University of East Anglia)
Fernández Bretón, David (Cinvestav)
Foreman, Matthew (UC Irvine)
Goldstern, Martin (TU Vienna)
Greenberg, Noam (Victoria University of Wellington)
Guzman, Osvaldo (University of Toronto)
Hernández Hernández, Fernando (Universidad Michoacana de San Nicolás de Hidalgo)
Hrusak, Michael (UNAM)
Jardón Santos, Mario (UNAM)
Kojman, Menachem (Ben Gurion University of the Negev)
Lambie-Hanson, Chris (Virginia Commonwealth University)
Larson, Paul (Miami University)
Martínez Ruiz, Iván (BUAP)
Mejia, Diego Alejandro (Shizuoka University)
Meza-Alcantara, David (UNAM)
Moore, Justin Tatch (Cornell University)
Mota, Miguel Angel (ITAM)
Navarro Flores, Sonia (UNAM)
Nies, Andre (The University of Auckland)
Nuñez-Rosales, Fernando (UNAM)
Ongay Valverde, Ivan (Univesity of Wisconsin)
Parente, Francesco (University of Leeds)
Plebanek, Grzegorz (University of Wroczlaw)
Raghavan, Dilip (National University of Singapore)
Ramos-García, Ulises Ariet (UNAM)
Schlicht, Philipp (University of Bristol)
Smythe, Ian (Rutgers University)
Sobota, Damian (University of Vienna)
Solecki, Slawomir (Cornell University)
Steprans, Juris (York University)
Szeptycki, Paul (York University)
Vignati, Alessandro (KU Leuven)
Yorioka, Teruyuki (Shizuoka University)
Zapletal, Jindrich (University of Florida)
Zindulka, Ondrej (Czech Technical University)

Number Theory in the Americas
August 11 - 16, 2019

Organizers:

Harald Helfgott (University of Goettingen/CNRS)
Moubariz Garaev (UNAM)
Lola Thompson (Oberlin College)

Our workshop was modeled after several other workshops that have been successful at fostering mathematical collaboration. Participants were divided into small project groups (3-5 participants) containing a mix of junior and senior researchers. Each group was led by one or two senior mathematicians. Project groups were assigned based on research area, with care taken to ensure that each group contained researchers from both continents who had not previously worked together. Background reading was sent to project group members several months in advance so that they were prepared to work on their respective problems together when they arrived in Oaxaca. Rather, it was meant to be an opportunity to exchange ideas and a starting point for potential future collaboration.

Participants:

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5169

Aldana, Clara (Universidad del Norte)
Barquero Sanchez, Adrian (Universidad de Costa Rica)
Barrera, Daniel (Universidad de Santiago de Chile)
Belolipetsky, Mikhail (IMPA)
Beneish, Lea (Emory University)
Carneiro, Emanuel (IMPA-Brasil and ICTP-Italy)
Chara, Maria (Universidad Nacional del Litoral)
Chirre Chavez, Carlos Andres (Norwegian University)
Di Benedetto, Daniel (University of British Columbia)
Erazo, Harold (Universidad del Valle)
Garaev, Moubariz (UNAM)
Garcia, Victor Cuauhtemoc (Universidad Autonoma Metropilitana)
Gomez Ruiz, Carlos Alexis (Universidad del Valle)
Gonzalez Sanchez, Diego (Instituto de Ciencias Matemáticas)
Gutiérrez Romo, Rodolfo Joaquín (Universidad de Chile)
Harris, Michael (Columbia University)
Helfgott, Harald (University of Goettingen/CNRS)
Krumm, David (Reed College)
Lalin, Matilde (Université de Montréal)
Lomeli, Luis (Pontificia Universidad Catolica de Valparaiso)
Lorenzo Garcia, Elisa (Universite de Rennes 1)
Lozano-Robledo, Alvaro (University of Connecticut)
Luca, Florian (University of the Witwatersrand)
Mantilla-Soler, Guillermo (Universidad Konrad Lorenz)
Marques, Diego (Universidade de Brasília)
Mejia Cordero, Julian (The Ohio State University)
Miatello, Roberto (FaMAF, UNCordoba)
Minguez, Alberto (University of Vienna)
Moreira, Carlos Gustavo (IMPA)
Murillo, Plinio G. P. (Korea Institute for Advanced Study)
Pacetti, Ariel (Universidad Nacional de Córdoba)
Romaña Ibarra, Sergio Augusto (IM-UFRJ)
Ryan, Nathan (Bucknell University)
Salgado, Cecilia (Max Planck Institute/ UFRJ)
Thompson, Lola (Oberlin College)
Tornaría, Gonzalo (Universidad de la República)
Treviño López, Enrique (Lake Forest College)
Trujillo, Carlos Alberto (Universidad del Cauca)
Várilly-Alvarado, Anthony (Rice University)
Zenteno, Adrián (Pontificia Universidad Católica de Valparaíso)
Zhang, Robin (Columbia University)

Out-of-Equilibrium Processes in Evolution and Ecology
August 18 - 23, 2019

Organizers:

Armita Nourmohammad (Max Planck Institute for Dynamics and Self-organization)
Vijay balasubramanian (University of Pennsylvania)
Serena Bradde (City University New York / University of Pennsylvania)
Marta Luksza (Icahn School of Medicine, Mount Sinai)

The physical limit of information processing has fascinated physicists since Maxwell's Demon was suggested as a thought experiment in 1867. Recent theoretical and experimental work on autonomous Maxwell's demon machines has led to significant progress in the field of information thermodynamics.

The goal of this program was to explore fundamental limits in evolution and ecology by combining theoretical approach grounded in statistical physics and information theory with molecular data. In this program we explored a wide range of biological systems, including rapid evolution of viral populations such as HIV and Influenza, somatic evolution of cellular populations in adaptive immune repertoire and in cancer, ecological interactions within bacterial communities. Although the specific biological characteristics of these systems may seem to be very distinct, we hoped to identify common features in their biophysical principles, and ultimately to devise a common framework to predict their evolutionary dynamics.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5150

Participants:

AlQuraishi, Mohammed (Harvard Medical School)
Bozic, Ivana (University of Washington)
Bradde, Serena (City University New York / University of Pennsylvania)
Bunin, Guy (Technion)
Chen, Hanrong (University of Pennsylvania)
Cremer, Jonas (University of Groningen)
Fisher, Daniel (Stanford University)
Francois, Paul (McGill University)
Good, Benjamin (University of California-Berkeley)
Gore, Jeff (MIT)
Goyal, Sidhartha (University of Toronto)
Grilli, Jacopo (Santa Fe Institute)
Kannan, Rathi (University of Chicago)
Kuehn, Seppe (Department of Physics)
Levine, Herbert (Northeaster University)
Luksza, Marta (Icahn School of Medicine, Mount Sinai)
Manhart, Michael (ETH Zurich)
Mayer, Andreas (Princeton University)
McGough, Lauren (University of Chicago)
Morozov, Alexandre (Rutgers University)
Murugan, Arvind (University of Chicago)
Noll, Nicholas (Biozentrum-Basel)
Nourmohammad, Armita (Max Planck Institute for Dynamics and Self-organization)
Otwinowski, Jakub (MPI for Dynamics and Self-organization)
Peliti, Luca (Santa Marinella Research Institute - Italy)
Pigolotti, Simone (Okinawa Institute of Science and Technology Graduate University)
Pinheiro, Fernanda (University of Cologne)
Ranganathan, Rama (University of Chicago)
Shou, Wenying (Fred Hutch Cancer Center)
Starr, Tyler (Fred Hutchinson Cancer Research Center)
Toprak, Erdal (UT Southwestern)
Vázquez-Salazar, Alberto (UNAM)
Weissman, Daniel (Emory University)
Wolf, Fred (Max Planck Institute for Dynamics and Self-Organization)
Zilman, Anton (University of Toronto)

Tilting Theory, Singularity Categories, & Noncommutative Resolutions
September 1 - 6, 2019

Organizers:

Osamu Iyama (Nagoya University)
José Antonio de la Peña (UNAM)
Henning Krause (Bielefeld University)
Michael Wemyss (University of Glasgow)

The Workshop studied bridges between representations of algebras on one side and algebraic geometry and singularity theory on the other. One such bridge is provided by a process called “tilting”, but it is currently not known when exactly tilting applies or which algebras are obtained. It was expected that the joint efforts of a group of internationally leading experts from many different areas of mathematics is yielding new insight in the difficult nature of these objects of study.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5161

Participants:

Argudín, Alejandro (UNAM)
Bautista, Raymundo (UNAM)
Burban, Igor (University of Paderborn)
Chan, Daniel (Univesity of New South Wales)
Dao, Hailong (University of Kansas)
Dyckerhoff, Tobias (Universitaet Hamburg)
Faber, Eleonore (University of Leeds)
Flores Galicia, Manuel (Bielefeld University)
Hara, Wahei (Waseda University)
Herschend, Martin (Uppsala University)
Hille, Lutz (University of Münster)
Hirano, Yuki (Kyoto University)
Hua, Zheng (The University of Hong Kong)
Ingalls, Colin (Carleton University)
Iyama, Osamu (Nagoya University)
Jasso, Gustavo (Rheinische Friedrich-Wilhelms-Universität Bonn)
Kalck, Martin (Freiburg University)
Keller, Bernhard (University Paris Diderot - Paris 7)
Krause, Henning (Bielefeld University)
Külshammer, Julian (Uppsala University)
Kvamme, Sondre (Université Paris-Saclay)
Lenzing, Helmut (University of Paderborn)
Meltzer, Hagen (Szczecin University)
Minamoto, Hiroyuki (Osaka Prefecture University)
Nájera Chávez, Alfredo (UNAM)
Pressland, Matthew (Universität Stuttgart)
Psaroudakis, Chrysostomos (Aristotle University of Thessaloniki)
Schnuerer, Olaf (Universität Paderborn)
Smith, Karen (University of Michigan)
Spenko, Spela (Vrije Universiteit Brussel)
Stevenson, Greg (University of Glasgow)
Takahashi, Ryo (Nagoya University)
Takahashi, Atsushi (Osaka University)
Thibault, Louis-Philippe (Norwegian University of Science and Technology)
Ueda, Kazushi (University of Tokyo)
Valdivieso Diaz, Yadira (University of Leicester)
Wemyss, Michael (University of Glasgow)
Wiegand, Roger (University of Nebraska)
Yoshino, Yuji (Okayama University)

Tropical Methods in Real Algebraic Geometry
September 8 -13, 2019

Organizers:

Lucia Lopez de Medrano (UNAM)
Brugallé Erwan (Université de Nantes)
Shaw Kristin (University of Oslo)

Tropical methods provide an extremely powerful new set of tools in the study of complex and real algebraic geometry. Among the branches of real algebraic geometry that have benefited from these tools are the construction of real algebraic varieties with controlled topology, and also real enumerative geometry. One of the roots of tropical geometry lies in Viro's patchworking invented in the late seventies to construct real algebraic varieties with a rich topology. Applications of tropical methods to real and complex enumerative geometry were initiated by Mikhalkin's seminal Correspondence Theorem in the early 2000. In particular, it supplied at that time the first method to compute Welschinger invariants of del Pezzo real toric surfaces. In recent years, new real, complex, and tropical enumerative invariants have been discovered. Computing and relating all these invariants is one of the current leading research directions in this field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5100

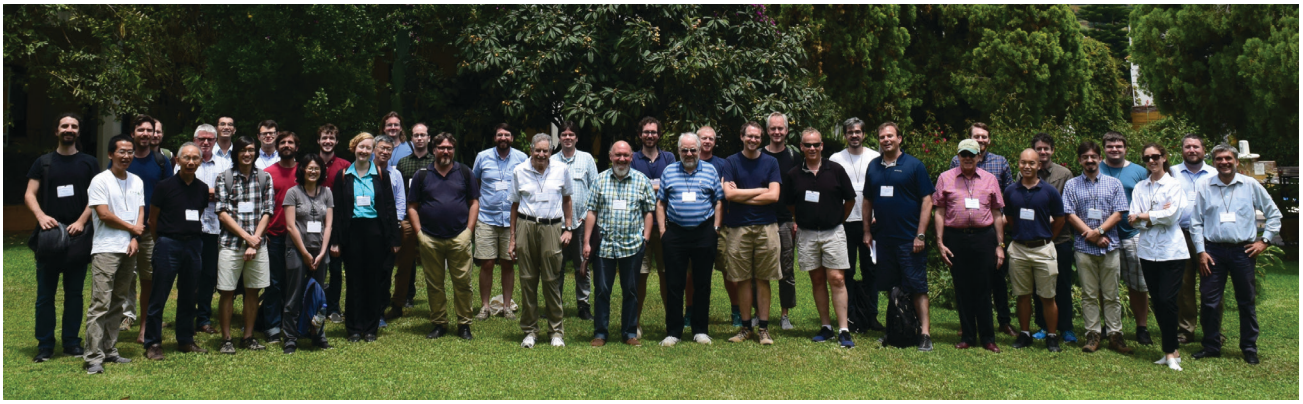
Participants:

Amini, Omid (École Polytechnique)
Arnal, Charles (Institut de Mathématiques de Jussieu)
Bertrand, Benoît (Université de Toulouse)
Blomme, Thomas (Institut de Mathématiques de Jussieu)
Bossinger, Lara (UNAM)
Brandt, Madeline (University of Berkeley)
Camacho, Angelito (Universidad Autónoma Chapingo)
Chaves Moreno, Levent Arturo (UNAM)
Chen, Xujia (Stony Brook)
Cotterill, Ethan (Universidade Federal Fluminense)
Cueto, Angelica (The Ohio State University)
Decaup, Julie (UNAM)
Erwan, Brugallé (Université de Nantes)
Forsgaard, Jens (Utrecht University)
Garay, Cristhian (CINVESTAV)
Gómez Galicia, Sergio Gerardo (Cinvestav)
Itenberg, Ilia (Sorbonne Université)
Jaramillo Puentes, Andres (Université de Nantes)
Kalinin, Nikita (Saint Petersburg State University)
Kristin, Shaw (University of Oslo)
Kummer, Mario (TU Berlin Germany)
Lang, Lionel (Stockholm University)
Le Texier, Cédric (Oslo University)
Lopez de Medrano, Lucia (UNAM)
Mangolte, Frederic (Université d'Angers)
Manzaroli, Matilde (Ecole Polytechnique)
Markwig, Hannah (Eberhard Karls Universität Tübingen)
Mihkalkin, Grigory (Université de Geneve)
Mostovoy, Jacob (CINVESTAV)
Nguyen, Thi Ngoc Anh (Université de Nantes)
Nicaise, Johannes (Imperial College London)
Nisse, Mounir (IHES)
Polyak, Michael (Technion)
Rau, Johannes (Universität Tübingen)
Renaudineau, Arthur (Université de Lille)
Scheiderer, Claus (Univ-Konstanz Germany)
Shustin, Eugenii (Tel Aviv University)
Sigurðsson, Baldur (UNAM)
Sottile, Frank (Texas A & M University)
Tyomkin, Ilya (Ben-Gurion University of the Negev)
Viro, Oleg (Stony Brook University)
Yu, Josephine (Georgia Tech)

Reverse Mathematics of Combinatorial Principles
September 15 - 20, 2019

Organizers:

Damir Dzhafarov (University of Connecticut)
Peter Cholak (University of Notre Dame)
Denis Hirschfeldt (University of Chicago)



Mathematicians prove theorems from basic assumptions called axioms. Today, the subject benefits from having "firm foundations'', by which we usually mean axioms sufficient to prove virtually all of the theorems we care about. A striking empirical fact repeatedly demonstrated in this area is that the vast majority of mathematical propositions can be classified into just five main types, roughly corresponding to five general mathematical principles that crop up all across mathematics, regardless of whether we are looking at algebra, calculus, geometry, or many other areas.

But there are exceptions, and they include some very important mathematical theorems. One of these is a famous theorem due to F. P. Ramsey, which can be colorfully stated as follows: at any dinner party with infinitely many guests, it is possible to find either infinitely many of the guests that all know each other, or infinitely many of the guests none of whom knows any of the others. This is a profound result in the area of combinatorics, with numerous applications in mathematics and computer science. And as it happens, it falls outside the five main types mentioned above. Understanding why this theorem, and others like it, behave differently from the vast majority of others, sheds light on the capacities and limitations of different ways of reasoning in mathematics, particularly in combinatorics, and in so doing, gives us a better picture of the underpinnings of mathematics as a whole.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5111

Participants:

Belanger, David (Ghent University)
Bienvenu, Laurent (CNRS & Université de Bordeaux)
Carlucci, Lorenzo (University of Rome)
Cholak, Peter (University of Notre Dame)
Chong, Chitat (National University if Singapore)
Conidis, Chris (College of Staten Island)
Dobrinen, Natasha (University of Denver)
Dorais, François (University of Vermont)
Dzhafarov, Damir (University of Connecticut)
Fiori Carones, Marta (University di Udine)
Frittaion, Emanuele (University of Leeds)
Goh, Jun Le (UW-Madison)
Greenberg, Noam (Victoria University of Wellington)
Harrison-Trainor, Matthew (Victoria University of Wellington)
Hirschfeldt, Denis (University of Chicago)
Hirst, Jeff (Appalachian State University)
Hölzl, Rupert (Bundeswehr University Munich)
Hughes, Noah (University of Connecticut)
Ingall, Corrie (Wake Forest University)
Ko, Li (University of Notre Dame)
Kolodziejczyk, Leszek (University of Warsaw)
Lempp, Steffen (University of Wisconsin - Madison)
Lerman, Manuel (University of Connecticut)
Marcone, Alberto (University of Udine - Italy)
Miller, Justin (University of Notre Dame)
Monin, Benoit (Paris- Creteil)
Mummert, Carl (Marshall University)
Patey, Ludovic (University of Lyon)
Pauly, Arno (Swansea University)
Sanders, Sam (TU Darmstadt & University of Leeds)
Shafer, Paul (University of Leeds)
Simpson, Stephen G. (Vanderbilt University)
Soldà, Giovanni (University of Leeds)
Valenti, Manlio (Universita di Udine)
Wang, Wei (Sun Yat-sen University)
Wcisło, Bartosz (University of Warsaw)
Weiermann, Andreas (University of Ghent)
Westrick, Linda Brown (Penn State University)
Yang, Yue (Singapore National University)
Yokoyama, Keita (JAIST)
Yoon, Jack (University of Hawaii)

Multi-Stage Stochastic Optimization for Clean Energy Transition September 22 - 27, 2019

Organizers:

Michel De Lara (Ecole des Ponts ParisTech)
Onésimo Hernández-Lerma (Cinvestav-IPN)
Alejandro Jofre (University of Chile)
Riadh Zorgati (Electricité de France)

The energy sector is expected to incorporate a growing share of random renewable energy, while minimizing costs. This challenge leads to large-scale multistage stochastic optimization problems. The workshop Multi-Stage Stochastic Optimization for Clean Energy Transition gathered international experts, both from academy and from industry, to work together on advances in numerical approaches to solve such problems.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5091

Participants:

Baucke, Regan (Ecole des Ponts ParisTech)
Camacho Franco, Oscar (CINVESTAV-IPN)
Carpentier, Pierre (ENSTA ParisTech)
Cedeño-Hernández, Miguel (CINVESTAV-IPN)
Chancelier, Jean-Philippe (École des Ponts ParisTech)
Chávez Casillas, Jonathan (University of Rhode Island)
De Lara, Michel (Ecole des Ponts ParisTech)
Dentcheva, Darinka (Stevens Institute of Technology)
Deride, Julio (Universidad Federico Santa María)
Devkota, Jyoti U. (Kathmandu University, Nepal)
Ferris, Michael C. (University of Wisconsin)
Fonseca-Morales, Alejandra (Cinvestav)
Freitas Paulo da Costa, Bernardo (Universidade Federal do Rio de Janeiro)
Gendreau, Michel (Polytechnique Montreal)
Georghiou, Angelos (McGill University)
Gómez Méndez, Sergio Joshafat (CINVESTAV)
Hernández González, Agustín (CINVESTAV)
Homem-de-Mello, Tito (Universidad Adolfo Ibanez)
Huaytalla Tineo, Dayana (CMM)
Infante Velasco, Saúl Diaz (Universidad de Sonora)
Jasso Fuentes, Héctor (CINVESTAV)
Jofre, Alejandro (University of Chile)
Laura-Guarachi, Leonardo (Cenace)
Leclere, Vincent (ENPC)
Ludkovski, Michael (University of California - Santa Barbara)
Mahajan, Aditya (McGill University)
Martin, Thomas (Ecole des Ponts ParisTech)
Mendoza-Palacios, Saul (El Colegio de México)
Philpott, Andy (University of Auckland)
Rockafellar, R.Terry (University of Washington)
Royset, Johannes (Naval Postgraduate School)
Rujeerapaiboon, Napat (National University of Singapore)
Ruszczynski, Andrzej (Rutgers)
Sagastizabal, Claudia (Unicamp Campinas)
Schultz, Rüdiger (University of Duisburg-Essen)
Shapiro, Alexander (Georgia Institute of Technology)
Vessaire, Cyrille (Ecole des Ponts ParisTech)

Soft Packings, Nested Clusters, and Condensed Matter
September 29 - October 4, 2019

Organizers:

Egon Schulte (Northeastern University)
Karoly Bezdek (University of Calgary)
Marjorie Senechal (Smith College)

Modeling the geometry of condensed matter is a challenging problem. The ongoing revolution in materials science sparked by the discovery of aperiodic crystals in 1982 demands the rapid development of new discrete geometric concepts and tools needed to study aperiodic structures. The classical "building block" model of crystal structure is fast yielding to new models in which nested atomic clusters link and perhaps overlap. Yet cluster models are still undeveloped geometrically, and poorly understood physically. The workshop focussed on "soft packing" and "nested clustering" phenomena in discrete geometric structures and on their applications to unraveling the internal atomic structure of solids and fluids. The workshop brought together researchers from a broad range of areas in mathematics and other sciences to share recent developments and emerging directions, encourage new collaborative ventures, and achieve further progress on fundamental questions in the field.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5142

Participants:

Bouniaev, Mikhail (University of Texas Rio Grande Valley)
Erokhovets, Nikolai (Moscow State University)
Frettloeh, Dirk (University of Bielefeld)
Garber, Alexey (The University of Texas Rio Grande Valley)
Glazyrin, Alexey (University of Texas Rio Grande Valley)
Heiss, Teresa (Institute of Science and Technology Austria)
Khan, Muhammed (University of Lethbridge)
Kim, Jaeuk (Princeton University)
Krivovichev, Sergei (Saint-Petersburg State University)
Kusner, Woden (Vanderbilt University)
Langi, Zsolt (Budapest University of Technology and Economics)
Lifshitz, Ron (Tel Aviv University)
Mochan Quesnel, Jaime Elias (UNAM)
Musin, Oleg (University of Texas Rio Grande Valley)
Pellicer, Daniel (UNAM)
Rieser, Antonio (CONACYT-CIMAT)
Schulte, Egon (Northeastern University)
Schulze, Bernd (Lancaster University)
Senechal, Marjorie (Smith College)
Servatius, Brigitte (Worcester Polytechnic Institute)
Streinu, Ileana (Smith College)
Taylor, Jean (Courant Institute - NYU)
Teich, Erin (University of Pennsylvania)
Torda, Miloslav (University of Liverpool)
Trejo-Escamilla, Briseida (UNAM)

Helly and Tverberg type Theorems
October 6 - 11, 2019

Organizers:

Deborah Oliveros (Universidad Nacional Autónoma de México)
Imre Bárány (Alfred Renyi Institute)
Luis Montejano (UNAM)
Janos Pach (Ecole Polytechnique Federale de Lausanne)

One of the most beautiful theorems in combinatorial convexity is due to Tverberg (1966). Nowadays Tverberg's theorem still remains central and is one of the most intriguing results of combinatorial geometry. It has been shown that there are many close relations between Tverberg's theorem and several important results in mathematics. Furthermore this theorem is closely connected with the multiplied or colorful versions of the theorems of Helly, Hadwiger and Caratheodory, that have multiple generalizations, applications and have motivated several open problems in discrete geometry. In the last two decades there has been an increasing amount of work that involve the use of new techniques in algebraic topology and other areas of mathematics. The workshop assembled the key people working in this area, in order to explore recent progress and to help focus on future directions of research.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5028

Participants:

Amaya, Efren Morales (Universidad Autónoma de Guerrero)
Antolin Camarena, Omar (UNAM)
Aronov, Boris (New York University)
Balitskiy, Alexey (MIT)
Bárány, Imre (Alfred Renyi Institute)
Blagojevic, Pavle (Freie Universitat)
Bracho, Javier (UNAM)
Bukh, Boris (Carnegie Mellon University)
Calles Loperena, Jose Jaime (CCM-UNAM Morelia)
Carnero Bravo, Andrés (National Autonomous University of Mexico)
De Loera, Jesus (University of California)
Dobbins, Michael (Dept of Math. Sc. Binghamton University (SUNY))
Fabila-Monroy, Ruy (Cinvestav)
Frankl, Nora (London School of Economics)
Frick, Florian (Carnegie Mellon University)
Garber, Alexey (The University of Texas Rio Grande Valley)
Glazyrin, Alexey (University of Texas Rio Grande Valley)
Goaoc, Xavier (Université de Lorraine)
Holmsen, Andreas (KAIST)
Ivanov, Grigory (TU Vienna)
Jiménez de Santiago, Valentín (UNAM)
Karasev, Roman (Moscow Institute of Physics and Technology)
Knauer, Kolja (Aix-Marseille Université)
López Campos, Gyivan Erick (UNAM)
Martínez Sandoval, Leonardo Ignacio (Sorbonne Université)
Montejano, Luis (UNAM)
Musin, Oleg (University of Texas Rio Grande Valley)
Naszodi, Marton (Alfred Renyi Institute of Mathematics)
Oliveros, Deborah (UNAM)
Pach, Janos (Ecole Polytechnique Federale de Lausanne)
Patak, Pavel (IST Austria)
Patáková, Zuzana (Institute of Science and Technology Austria)
Pérez Contreras, Eric Pauli (UNAM)
Por, Attila (Western Kentucky University)
Ramirez Alfonsin, Jorge (Universite de Montpellier)
Roldán-Pensado, Edgardo (UNAM)
Soberón, Pablo (Baruch College)
Tancer, Martin (Charles University in Prague)
Tardos, Gabor (Renyi Institute, Budapest)
Torres Hernández, Antonio de Jesús (UNAM)
Toth, Csaba (California State University Northridge)
Wagner, Uli (IST Austria)
Welzl, Emo (ETH Zurich)
Yuan, Liping (Hebei Normal Universtiy)
Zerbib, Shira (University of Michigan)

Modularity and Moduli Spaces
October 20 - 25, 2019

Organizers:

Brandon Levin (University of Arizona)
Rebecca Bellovin (Imperial College London)
Matthew Emerton (University of Chicago)
David Savitt (Johns Hopkins University)

The year 2019 marked the 25th anniversary of the resolution of Fermat's Last Theorem, as well as the 20th anniversary of the proof that all elliptic curves over the rational numbers are modular. The many mathematical ideas that were introduced in these celebrated results have blossomed in the intervening years, leading to the development of entire areas of research in the contemporary arithmetic of automorphic forms: potential automorphy theorems, the p-adic Langlands program, and the weight part of Serre's conjecture for higher rank groups, just to name some of them. This workshop brought together leading and emerging experts in these several areas, to take stock of the current state of developments in them, and to chart a course for future progress.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5210

Participants:

Allen, Patrick (UIUC)
Bartlett, Robin (Max Planck Institute, Bonn)
Bergdall, John (Bryn Mawr College)
Booher, Jeremy (University of Canterbury)
Boxer, George (University of Chicago)
Cais, Bryden (University of Arizona)
Calegari, Frank (University of Chicago)
David, Agnes (Université de Franche-Comté)
Ding, Yiwen (Peking University)
Dotto, Andrea (Imperial College London)
Emerton, Matthew (University of Chicago)
Feng, Tony (MIT)
Fintzen, Jessica (University of Cambridge and University of Michigan)
Gee, Toby (Imperial College London)
Gerbelli-Gauthier, Mathilde (University of Chicago)
Hellmann, Eugen (Universitat Munster)
Helm, David (Imperial College London)
Herzig, Florian (University of Toronto)
Hsu, Chi-Yun (UCLA)
Hu, Yongquan (Morningside Center of Mathematics, AMSS)
Iyengar, Ashwin (King's College London)
Le, Daniel (University of Toronto)
Le Hung, Bao (Northwestern University)
Levin, Brandon (University of Arizona)
Liu, Tong (Purdue University)
Liu, Ruochuan (Peking University)
Manning, Jeffrey (UCLA)
Paskunas, Vytautas (Universitaet Duisburg Essen)
Pereira Lourenço, João Nuno (Universität Bonn)
Pérez Buendía, Jesús Rogelio (CIMAT)
Richarz, Timo (Technische Universität Darmstadt)
Savitt, David (Johns Hopkins University)
Shin, Sug Woo (University of California, Berkeley)
Specter, Joel (John Hopkins University)
Vigneras, Marie-France (Jussieu Paris 7)
Xiao, Liang (Beijing International Center for Mathematical Research)
Yao, Zijian (Harvard University)
Ye, Lynnelle (Stanford University)
Zhu, Xinwen (California Institute of Technology)
Zicheng, Qian (University of Toronto)

Computational Harmonic Analysis and Data Science
October 27 - November 1, 2019

Organizers:

Thomas Strohmer (University of California - Davis)
Emmanuel Candes (Stanford University)
Ronald Coifman (Yale University)
Amit Singer (Princeton University)

Future progress in science and technology depends crucially on our ability to derive new discoveries and deep understanding from complex and massive datasets. However, uncertainty, scale, non-stationarity, noise, and heterogeneity are fundamental issues impeding progress at all phases of the pipeline that creates knowledge from data. New mathematical challenges arise as current algorithms are in many cases no longer able to keep up with the numerous demands and changing environments as well as the huge amounts of data that need to be processed and analyzed. Fundamentally new ideas and approaches are needed and will require a close collaboration between mathematicians, statisticians, computer scientists, and engineers. The workshop brought together world leading experts at the intersection of applied harmonic analysis, machine learning, optimization, and signal processing to present recent developments and to foster new interactions. The direct interaction of mathematicians, statisticians, engineers, and computer scientists, made possible by this workshop, made for an efficient intellectual feedback loop, which is central to achieving the urgently needed breakthroughs in machine learning and data science.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5061

Participants:

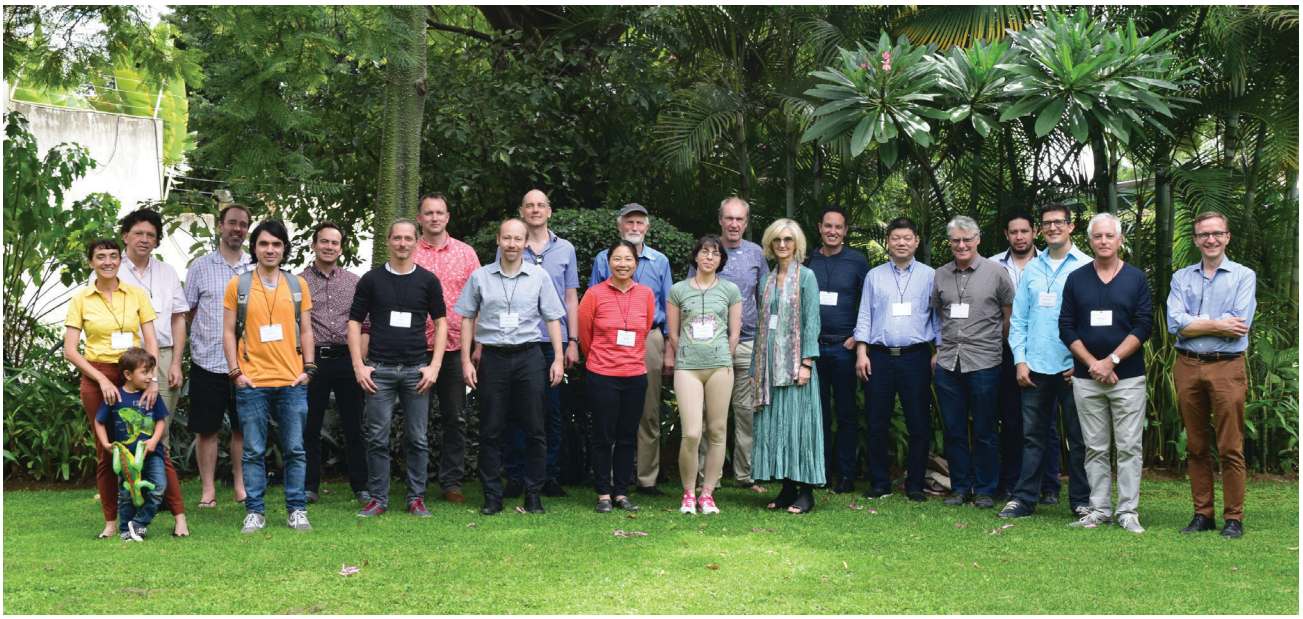
Barahona, Igor (UNAM)
Bodmann, Bernhard (University of Houston)
Boelcskei, Helmut (ETH Zurich)
Boumal, Nicolas (Princeton University)
Cheng, Xiuyuan (Duke University)
Cloninger, Alex (University of California San Diego)
Cortés Poza, Yuriria (CIMAT-Mérida)
Cuturi, Marco (Google / CREST ENSAE)
d'Aspremont, Alexandre (CNRS - ENS)
Delgado-Vences, Francisco (UNAM)
Deng, Shaofeng (University of California - Davis)
Fornasier, Massimo (Technische Universität München)
Gao, Tingran (University of Chicago)
Guerrero Arroyo, Edgar Alejandro (University of Guadalajara)
Jalal, Ajil (University of Texas, Austin)
Jin, Ruhui (University of Texas, Austin)
Kileel, Joe (Princenton University)
Krahmer, Felix (Technical University Munich)
Kutyniok, Gitta (Technische Universität Berlin)
Lederman, Roy (Yale University)
Leeb, William (University of Minnesota)
Ling, Shuyang (New York University)
Maggioni, Mauro (Johns Hopkins University)
Mallat, Stephane (Ecole Polytechnique)
Marshall, Nicholas (Princeton University)
Mhaskar, Hrushikesh (Claremont Graduate University)
Mishne, Gal (Yale University)
Mixon, Dustin (Ohio State University)
Price, Eric (UT Austin)
Rauhut, Holger (RWTH Aachen University)
Singer, Amit (Princeton University)
Steinerberger, Stefan (Yale University)
Strohmer, Thomas (University of California - Davis)
Talmon, Ronen (Technion)
Tropp, Joel (California Institute of Technology)
Villar, Soledad (New York University)
Wolf, Guy (Université de Montréal)
Wright, John (Columbia University)
Zhao, Zhizhen (University of Illinois Urbana - Champaign)

Recent Developments in Mathematical and Computational Biomedicine November 3 - 8, 2019

Organizers:

Tatiana T. Marquez Lago (University of Alabama - Birmingham)

Kevin Burrage (Queensland University of Technology)
Grant Lythe (University of Leeds)



Increasingly powerful technologies such as high-throughput sequencing, 'multi-omics', chromosome capture, supercomputing, high resolution microscopy and imaging, are providing components of personalised data from the subcellular to organ level at rates that were undreamt of even ten years ago. Mathematical modelling, simulations, and statistical analysis attempts to make sense of this data, and integrate it into multi-scale models that are increasingly used in health care settings. Likewise, mathematical and computational approaches provide cost-effective tools that mitigate the expense and ethical considerations of experimentation. This workshop brought together experts in a variety of areas within mathematical and computational sciences, medicine and biomedical informatics, to integrate expert knowledge and set a forum for interdisciplinary personalised medicine research for the 21st century.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5085

Participants:

Abu-Shah, Enas (University of Oxford)
Altan-Bonnet, Gregoire (National Cancer Institute - NIH)
Burrage, Kevin (Queensland University of Technology)
Cannon, Judy (University of New Mexico)
Coombs, Dan (University of British Columbia)
Enciso, German (University of California Irvine)
Erban, Radek (University of Oxford)
Haack, Fiete (Rostock University)
Hancock, John (The University of Texas Health Science Center at Houston)
Hodgkin, Phil (Walter and Eliza Hall Institute of Medical Research)
Kenney, Linda (National University of Singapore)
Leier, Andre (University of Alabama - Birmingham School of Medicine)
Lythe, Grant (University of Leeds)
Marquez Lago, Tatiana T. (University of Alabama - Birmingham)
Nahmad, Marcos (Center for Research and Advanced Studies)
Padilla, Pablo (UNAM)
Palafox González, Abel (Universidad de Guadalajara)
Peña Miller, Rafael (UNAM)
Preciat, German (Universities of Luxembourg & Leiden)
Sheetz, Michael (National University of Singapore and Columbia University)
Simpson, Matthew (Queensland University of Technology)
Tian, Tianhai (Monash University)

Zero-Sum Ramsey Theory: Graphs, Sequences and More
November 10 - 15, 2019

Organizers:

Amanda Montejano (Universidad Nacional Autónoma de México)
Yair Caro (University of Haifa-Oranim)
Adriana Hansberg (Universidad Nacional Autónoma de México)

Zero-sum Ramsey theory (also Zero-sum theory) is a very rich branch in Combinatorics which combines tools from Number theory, Algebra, Linear algebra, Graph theory, Discrete analysis and other branches in Mathematics. It deals with problems of the following kind: given a combinatorial structure whose elements are assigned different weights (usually elements from an Abelian group A), one seeks for conditions that guarantee the existence of certain substructure whose weights of its elements sum up to zero (in A). Since the beginning of the 60's, where the first result of this kind by Erd\H{o}s, Gizburg and Ziv was published, the study of such kind of problems has received growing interest among Mathematicians.

With this workshop, we aimed to give Zero-sum Ramsey theory more visibility and gather different mathematicians with a mutual interest in the subject in order to foster the exchange of ideas and recent advances as well as to encourage young researchers to get involved. Moreover, we wanted to make awareness of the inter-disciplinary aspect of the topic and establish new directions of future research.
For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5132

Participants:

Adhikari, Sukumar Das (Ramakrishna Mission Vivekananda Educational and Research Institute)
Arévalo Loyola, Alma Rosario (UNAM)
Axenovich, Maria (Karlsruhe Institute of Technology)
Balandraud, Eric (Université de Bordeaux)
Bialostocki, Arie (University of Idaho)
Caro, Yair (University of Haifa-Oranim)
Conlon, David (California Institute of Technology)
Dailly, Antoine (Université de Grenoble)
Díaz Patiño, Juan Carlos (Universidad Nacional Autonoma de México)
Eliahou, Shalom (Université du Littoral Côte d'Opale)
Elsholtz, Christian (Graz University of Technology)
Girard, Benjamin (Sorbonne Université)
Grynkiewicz, David (University of Memphis)
Guadiana, Mario (UNAM)
Hansberg, Adriana (Universidad Nacional Autónoma de México)
Hernández, Felipe (Universidad Nacional Autónoma de México)
Huicochea, Mario (CONACyT/UAZ)
Jungic, Veselin (Simon Fraser University)
Matos, Tonatiuh (UNAM)
Merino, Criel (UNAM)
Montejano, Amanda (Universidad Nacional Autónoma de México)
Muyesser, Necati (Carnegie Mellon University Pennsylvania)
Narayanan, Bhargav (Rutgers University)
Nathanson, Melvyn (Lehman College CUNY)
Ordaz, Oscar (Paris 8)
Pach, Péter Pál (Budapest University of Technology and Economics)
Reyes Quiroz, Mónica Andrea (Universidad Autónoma del Estado de México)
Roldán-Pensado, Edgardo (UNAM)
Schmid, Wolfgang (Universite Paris 8)
Schmitt, John (Middlebury College)
Sissokho, Papa Amar (Illinois State University)
Song, Zixia (University of Central Florida)
Suárez, David (Universidad Politécnica de Querétaro, UPQ)
Ventura, Denae (UNAM)
Vilchis, Carlos (Universidad Nacional Autónoma de México)

Moduli and Invariants
November 17 - 22, 2019

Organizers:

Eduardo Gonzalez (UMASS Boston)
Artan Sheshmani (Harvard University (CMSA))
Pablo Solis (Stanford University)

This workshop brought together groups of researchers from different groups studying enumerative invariants from moduli spaces of curves. The workshop discussed recent advances in Donaldson-Thomas theory, Gromov-Witten theory and equivariant extensions of such theories.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5171

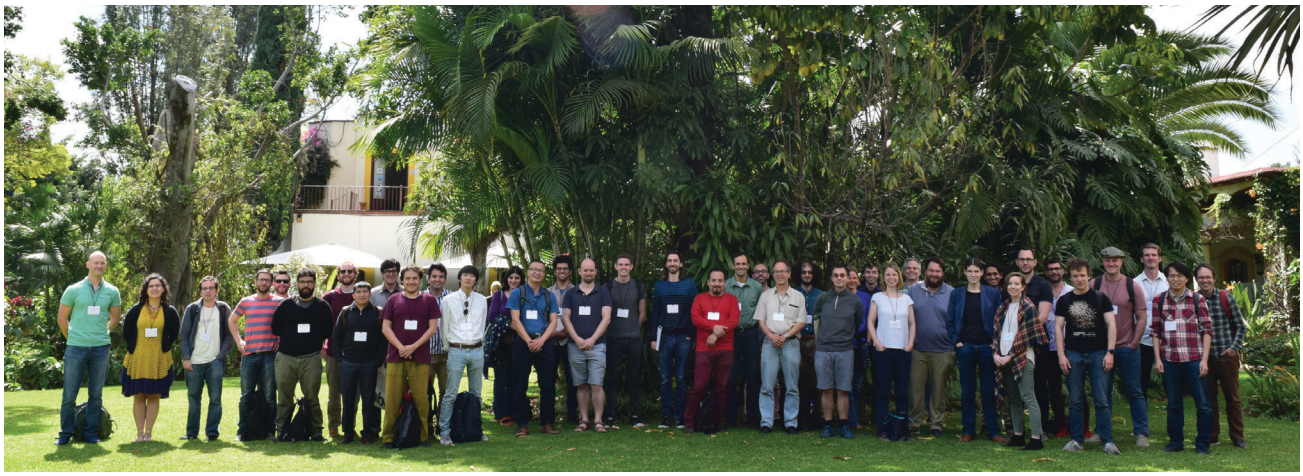
Participants:

Baranovsky, Vladimir (University of California Irvine)
Behrend, Kai (University of British Columbia)
Bejleri, Dori (Harvard University)
Borisov, Dennis (University of Windsor)
Brambila-Paz, Leticia (CIMAT)
Bryan, Jim (University of British Columbia)
Chen, Qile (Boston College)
Colin Hernandez, Nestor (CINVESTAV)
Cruz Morales, John Alexander (Universidad Nacional de Colombia)
Davison, Ben (University of Edinburgh)
Donagi, Ron (University of Pennsylvania)
Donovan, Will (Tsinghua University)
Dumitrescu, Olivia (Central Michigan University)
Gholampour, Amin (University of Maryland)
Gomez-Mont, Xavier (CIMAT)
Gonzalez, Eduardo (UMASS Boston)
Janda, Felix (Institute for Advanced Study)
Katz, Sheldon (University of Illinois)
Kiem, Young-Hoon (Seoul National University)
Kool, Martijn (Universiteit Utrecht)
Lozano Huerta, César (CONACYT - UNAM)
Oh, Jeongseok (KIAS Korea)
Shen, Yefeng (University of Oregon)
Sheshmani, Artan (Harvard University (CMSA))
Shoemaker, Mark (Colorado State)
Webb, Rachel (University of Michigan)
Xicoténcatl, Miguel (CINVESTAV)
Zhang, Ming (University of British Columbia)

Algebraic and Geometric Categorification
December 1 -6, 2019

Organizers:

Alistair Savage (University of Ottawa)
Jonathan Brundan (University of Oregon)
Monica Vazirani (University of California - Davis)
Ben Webster (University of Waterloo)



Categorification is a relatively new and very exciting field of mathematics bridging a number of inter-related areas, including representation theory, combinatorics, algebraic geometry, geometric topology, and mathematical physics. Its philosophy is that many mathematical structures that appear to be fundamental are, in fact, mere shadows of a higher and richer mathematical reality.

The workshop brought together researchers working in the various facets of categorification. This resulted in the development of new connections between fields and foster further interaction between mathematicians working in different areas. Since it is young as a field itself, categorification has attracted the interest of many mathematicians at the start of their career. Reflecting this, the participants in the workshop were selected to foster interaction between established mathematicians and younger participants at transitional career stages.

For details, please refer to the workshop webpage
https://www.birs.ca/events/2019/5-day-workshops/19w5074

Participants:

Argudín, Alejandro (UNAM)
Bowman, Chris (University of Kent)
Brundan, Jonathan (University of Oregon)
Castillo, Alberto (UNAM)
Cautis, Sabin (University of British Columbia)
Cely, Jorge (University of Haifa)
Dancso, Zsusanna (University of Sydney)
Davison, Ben (University of Edinburgh)
Entova-Aizenbud, Inna (Ben Gurion University)
Geiss, Christof (UNAM)
Gonzalez, Nicolle (UCLA)
Griffeth, Stephen (Universidad de Talca)
Hazi, Amit (University of London)
Hogancamp, Matthew (Northeastern University)
Kamnitzer, Joel (University of Toronto)
Kim, Myungho (Kyung Hee University)
Kujawa, Jonathan (University of Oklahoma)
Labardini-Fragoso, Daniel (UNAM)
Lauda, Aaron (University of Southern California)
Licata, Anthony (Australian National University)
Loseu, Ivan (Yale University)
Makisumi, Shotaro (Columbia University)
Manolescu, Ciprian (UCLA)
McNamara, Peter (University of Melbourne)
Miemietz, Vanessa (University of East Anglia)
Nájera Chávez, Alfredo (UNAM)
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Casa Matemática Oaxaca (CMO) is an International research facility affiliated with the Banff International Research Station (BIRS) of Canada. CMO will host scientific activities and gather mathematicians from around the world in an environment that will promote innovative ideas in the mathematics field. CMO will also support activities to promote local development through research and teaching of mathematics.

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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 Economic Development and Trade, and Mexico's Consejo Nacional de Ciencia y Tecnología (CONACYT).

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